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ECONOMIC GEOGRAPHY

JULY

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Jacob G. Lipman

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Samuel van Valkenburg

THE PACIFIC COAST HALIBUT FISHERY
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ECONOMIC GEOGRAPHY OF BULGARIA
Joseph S. Roucek

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SOIL PROBLEMS

NEVER in the history of America have her people become so acutely conscious of their dependence upon her soil as in the present state of serious agricultural, industrial, and general economic distress. Never have they shown such concern for the conservation of her soil and its fertility as in the present mad search for methods to prevent its leaching and erosion, for some remedy for its failing productivity.

As long as new virgin land remained unexploited and uncultivated, her people did not feel that keen interest in soil that the peoples of Eurasia long ago realized and made part of their thinking and planning. Now that pristine fields are forever gone, they have awakened with a shock to the problems that confront them in caring for their soils wisely and effectively; in their alarm and eagerness to do something remedial at once they are likely to err almost as gravely in too precipitate action as they have erred in thus far not acting at all.

Now is the time for deliberate thought, deliberate planning, cautious analysis of the problems, that the care of the soil presents, not panicky, impulsive, often unwarranted programs that may cause more harm than good. Now is the time for rigorous, well-directed research, for painstaking study of the conditions that have given rise to present problems, of the relationship in economic and social adjustments to soils, of the consequences of policies that may be considered in attempting to solve the problems.

The scientific study of the soil is old, yet ever new. So recent is the development of soil science based upon the characteristics of the soil itself, that no one has yet been able fully to evaluate the new systems of classification, to interpret adequately the significance of the newly recognized attributes of soils, to appraise the effect of some of the results new data regarding them seem to yield. Until knowledge of all these factors in the problem that more intelligent use of the soils entails, is much wider, deeper, and surer, America should proceed with deliberation and caution in solving it.

ECONOMIC GEOGRAPHY

VOL. 11 JULY, 1935 No. 3

SOCIAL AND ECONOMIC FACTORS IN LAND-USE PLANNING IN THE NORTHEASTERN STATES

Jacob G. Lipman

THE common ownership of land by tribes and clans was widespread in the ancient world. Hunting and grazing rights were attached to such ownership. We are reminded of this condition by the name "commons" attached to areas of land originally used for grazing or recreation by members of the community. The Boston Commons is a case in point. In the less civilized countries, common hunting and grazing rights survive. In Palestine and Syria, for instance, the Bedouins are allowed to graze their camels and other animals over the entire countryside after the crops are harvested by the owners.

The feudal system was based, in essence, on the ownership of the land by the sovereign and its control by his vassals. Hunting and grazing rights were maintained in accordance with a definite political and social organization. In our own country, the Public Domain was the property of the nation. It constituted at one time more than half of the area of the continental United States. With the aid of legislation and through other expedients, most of the Public Domain was gradually transferred to private ownership. This facilitated land settlement and the development of the young country. It involved, at the same time, errors and abuses, which have called for a reckoning. Much has been written on the subject of enclosures in England. The story of the movement is told in a most interesting way by Prothero in his "English Farming Past and Present." The entire movement represented a major social transformation. The evolution and survival of democracy in England are intimately tied up with the history of land use in the British Isles. Something akin to it may be found in the history of our own country, particularly as it concerns the exploitation of our forest resources, our range lands, and the development of our livestock industry.

ERA OF EXPANSION

The trend of population spread and land use in the United States is clearly indicated by the table on page 218.

The young republic had a population of only four million people in 1790. Even at that, about one hundred years of more systematic farming in the New England States produced a condition which compelled Jared Elliott [1] to issue a warning. Writing about the middle of the eighteenth century, he complained about the scarcity of hay, corn, and wheat. He tells us in his Second Essay, p. 29, that "When our forefathers settled here, they entered a Land which probably never had been Ploughed since the Creation; the Land being new they depended upon the natural Fertility of

[1] Essays Upon Field Husbandry in New England and Other Papers.

STATUS OF POPULATION AND AGRICULTURE IN THE NORTHEASTERN STATES

NEW ENGLAND, NEW YORK, PENNSYLVANIA, NEW JERSEY, MARYLAND, DELAWARE, WEST VIRGINIA

	Population	*Improved Land Acres*	*Number of Farms*	*Value Crop Production*
1880	16,207,415	54,267,617	808,079	495,300,168
1890	19,380,646	51,067,587	781,521	471,673,020
1900	23,378,274	48,689,957	826,079	462,237,872
1910	28,587,360	46,165,860	813,625	581,926,404
1920	32,798,418	41,986,796	727,048	1,419,130,436
1930	38,026,202	33,168,407	618,079	752,170,632

POPULATION AND LAND

	1790	*1820*	*1850*	*1880*	*1900*	*1930*
Population, Total	4,000,000	10,000,000	23,000,000	50,000,000	76,000,000	123,000,000
Population, Rural	4,000,000	9,000,000	20,000,000	39,000,000	51,000,000	62,000,000
Farms, Number			1,449,000	4,000,000	5,737,000	6,288,000
Land in Farms (acres)			293,000,000	536,000,000	838,000,000	986,000,000
Land in Crops (acres)				177,000,000	293,000,000	359,000,000
Population, Urban per cent	3.3	4.9	12.5	22.7	32.9	49.1

the Ground, which served their purpose very well, and when they had worn out one piece they cleared another, without any concern to amend their Land, except a little helped by the Fold and Cart-dung, whereas in England they would think a man a bad Husband, if he should pretend to sow Wheat on Land without any Dressing."

Practically all of the population in 1790 was rural. Thirty years later, the population of the United States had increased to ten millions, and of this 90 per cent were designated as rural. The figures given above show how, after 1850, there was striking growth of both urban and rural populations. But the country was obviously becoming rapidly urbanized. There was an increase in the number of farms, an increase in land in farms, and a no less striking increase in land in crops. More than half of the area of the continental United States had become farm land by 1930. While about half of the population was then designated as rural, the actual farm population was not greater than about one-quarter of the total. The rest of the rural population was located in villages and small towns.

The expedient noted by Elliott of abandoning land that had begun to show signs of depletion and the taking up of virgin land was continued throughout the period of expansion and the westward march of our farm population. This movement led to many important changes, such as the shift in the centers of agricultural production, the decline in the value of farm lands in the older sections of the United States, the development of industries and commerce, the urbanization of large regions in the East and Middle West, and the migration of young people from the farm to the city. Inevitably, these changes were accompanied by important economic and social transitions.

The World War gave further stimulus to a process which had been going on for more than half a century. The great demand for, and relatively high prices of, agricultural commodities caused an increase in the acreage of such staple crops as wheat, oats, corn, and cotton. A similar increase occurred in the number of beef and dairy cattle, hogs, and poultry. Land not formerly considered profitable for the production of wheat, corn, and cotton was used for the purpose as a result of the high prices. Thus, much land submarginal under normal conditions was made arable, and a condition was created which called for a reckoning in the post-war years.

WHAT HAPPENED

The expansion in our farm business was only one of the causes that brought our farmers face to face with a serious

situation. The mechanization of farming decreased the need for animal power. This was followed by a striking shrinkage in the number of horses and mules, and a corresponding shrinkage in the acreage required for maintaining these animals. Our new immigration policy and the falling birth rate caused a decline in the number of potential consumers of our farm commodities. Our export trade was adversely affected because of our tariff policy, our refusal to continue the granting of rather extraordinary loans to foreign countries, and our inability or unwillingness to allow products from abroad to come in in sufficiently large volume to permit our exporting of sufficiently large quantities of wheat, cotton, pork, and other agricultural export staples.

Throughout a period of several decades, we had systematically built up a great export trade. Even without the stimulus of the World War, this export trade called for the services of many millions of acres. As the need for the large acreage decreased, for reasons given above, the volume of products offered in our domestic markets increased relatively, as well as absolutely. At any rate, the competition among our farmers became more severe. Farm commodity prices were lowered and the value of farm lands and farms correspondingly decreased. Our farming business, except in abnormal times, was never profitable in comparison with other types of business. This was generally true, despite numerous exceptions.

New economic and technological factors have made themselves felt to an increasing extent since the beginning of the present century. Improved transportation and refrigeration widened the limits of the territory supplying any given population. In fact, the production and marketing of certain perishable products developed into a nation-wide system, with sources of supply located even beyond the boundaries of the United States. We need but think, in this connection, of the practical disappearance of the vegetable-forcing industry in the Northeastern States. The Carolinas, Georgia, Louisiana, Florida and the Gulf region in the Southwest were able to displace fresh vegetables formerly produced locally. The volume of this showed a great increase, and the vegetable growing business as a whole

FIGURE 1.—Vegetables under glass in South Jersey, an intensive and profitable use of the land, based not so much upon its fertility as upon the ease and cheapness with which it may be worked. Probably the most effective factor in making the use of the land so profitable is the proximity of a large consuming population in the urban centers of commerce and industry along the Atlantic seaboard.

became more speculative. The Pacific Coast, Mexico, the West Indies, Central America, and even South America, have found a market for their vegetables in our larger or smaller cities.

The changes which have taken place in the agriculture of the Northeastern States since the middle of the last century are quite obvious. A hundred years ago, they produced a large volume of wheat and of other small grains. They grew an impressive acreage of corn. From their own land, they supplied most of their needs as to beef, mutton, pork, wool, hides, etc. They were, by and large, a general farming area. When the Civil War was over and the remarkable westward march of our agriculture was resumed, the Northeast was compelled to pass from one stage of specialization to another. Beef cattle were displaced by dairy animals. Cheese factories were established and a cheese export trade of substantial proportions was developed. Competition from areas farther west compelled a change from cheese manufacture to butter making. Still later, market milk became the major agricultural commodity of our dairy farmers.

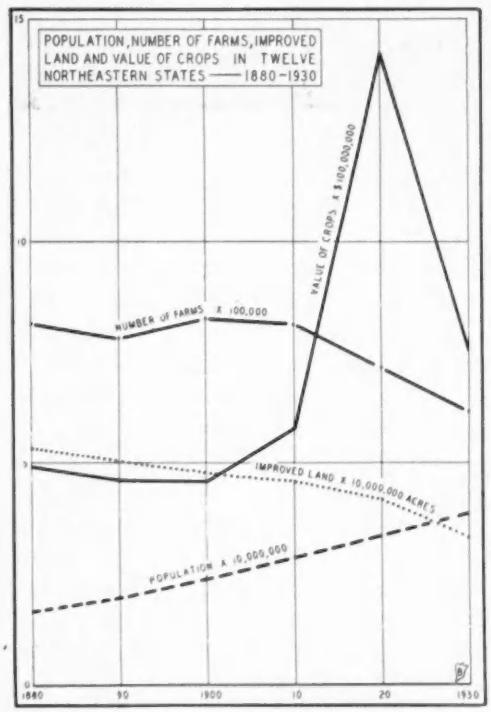


FIGURE 2.—A most interesting series of correlations can be made from this graph of the population, number of farms, improved land, and value of crops in twelve northeastern states from 1880–1930.

We may think in a similar way of specialization in the production of small fruits, tree fruits, certain types of vegetables, eggs and poultry meat, ornamental plants, cut flowers, and a considerable number of other products. The production of crops of high commercial value was forced upon our farmers in the Northeast, not only because of the competition of cheaper land and labor, but also by the increasing production costs due to higher taxes, higher wages and higher standards of living. The evolution of agriculture in the Northeast is analogous to that of Western Europe. Always cheaper land, lower investments, and large-scale production with the aid of machinery and mechanical power, drove the older agricultural regions to higher yields per acre, higher quality products and more direct contacts with the consumer. As the competition became more keen, land of lesser value was thrown out of cultivation, the number of farms decreased, and the migration of young people from the open country to the cities was intensified. It is the boast of many of our captains of industry that on the farm they have built a foundation of character, physical vigor, and mental drive for the development of great enterprises in our economic life. All of this has been part of our national evolution. In the colonial days, agriculture was the major national interest. In our own day, agriculture has become subordinate to what to many may seem more important interests.

Before we proceed with the subject

of land-use planning, let us note some other facts and conditions which must influence our future land-use policies. Reference has already been made to increased production efficiency. Northeastern agriculture was able to survive partly because of the use of commercial fertilizers and lime, and other expedients of soil management that help toward higher yield levels. It has been able to survive because of the development of better types of plants and animals by selection and breeding. The Northeastern States produce more milk per cow, more eggs per hen, more pounds per acre, than they did at the beginning of this century. They have been able to survive through the development of more effective means for the protection of their plants and animals against the attacks of fungi, bacteria, insects, and parasites. They have been able to survive because of the emphasis they have laid on quality. Beyond that, they have reduced the wastage of perishables by better storage and refrigeration methods, better handling and distribution methods, and the use of products possessing better shipping quality. They have put much effort into devising various methods of processing, particularly canning, preserving, dehydration, fermentation, and the like. Inferior land, as well as inferior plants and animals, had to be eliminated. For that matter, inferior humans have also ceased to play a prominent part in our farm industry, even though they have become more of a social problem.

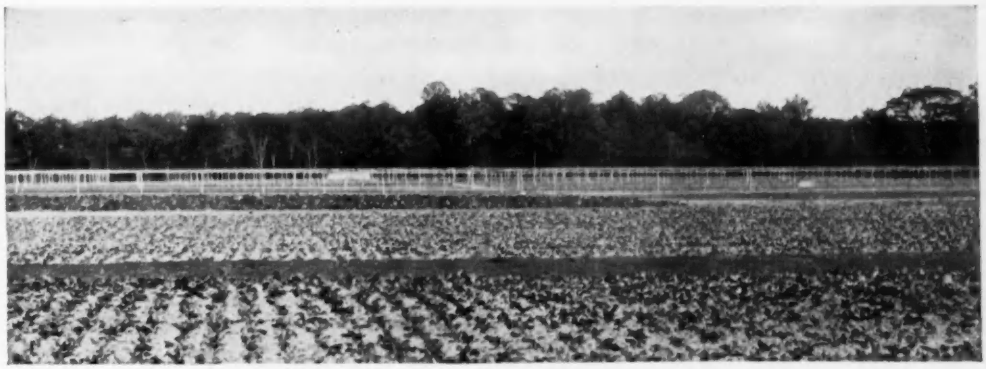


FIGURE 3.—Overhead irrigation in the truck growing section of South Jersey helps to insure a profitable crop. The market for all the produce in the neighboring metropolitan centers demands, and accepts, practically all the grade A fruit and vegetables that the farmers can supply. Not only are the physical conditions of the region suitable for such intensive agriculture, but the character of the population and the proximity of adequate market makes trucking and fruit growing generally successful, particularly on the best land and under the direction of the best farmers.

PRESENT-DAY TRENDS

We now find ourselves in a situation that will compel us to make changes more or less far-reaching in our whole economic and social structure. A greater degree of centralization and control has been developing in our industries and commerce for some years. These have been compelled to adjust themselves to an increasingly larger scale. The small business man is less often able to survive and is forced to seek employment with one or another of our great corporations. It has often been asked why corporation farming should not be as effective economically as corporations controlling the manufacture of capital goods, consumers goods, or public utilities, transportation, banking, retail merchandizing, etc. The answer is obvious enough. The indi-

FIGURE 4.—Though the rainfall is generally ample throughout most of the truck growing season, occasional longer periods than usual without rain may tend to conditions of drought on the relatively coarse, sandy, well-drained soils of South Jersey. Overhead irrigation, though somewhat expensive, helps appreciably to remove the hazard of drought, and consequently the hazard of crop failure. The truck farmer and the small fruit farmer thus control their production better than they otherwise could.

vidual farmer is always confronted by two major uncertainties. One is that of season; the other, of the range of prices in his particular markets. If the individual farmer has a poor season, or is obliged to sell his crops at a price below the cost of production, he can survive, for a time at least, because he is willing to forego compensation for his own labor. The corporation farm, which employs a manager and must regularly pay its employees, finds itself in a position where paid labor must compete with unpaid labor. Had conditions been similar in our agriculture to those in industry and commerce, corporation farming would have been by this time as prominent a feature of our economic life as are corporation enterprises in other fields.

Within the present decade, something has happened that compels us to revise our economic thinking and procedures. For the reasons already noted, we can do with a smaller agricultural plant just as we can do with a lessened production capacity in our industries. Machine efficiency has not yet reached its final stage. Indeed, the use of power and labor-saving devices will make themselves felt in the future to a greater degree than they have been felt in the past. Except as we increase our wants and create new ones, the greater production efficiency will almost automatically force a reduction in the length of the working day and the working week. But, when people work less and, at the same time, lower their production output, they must be content with smaller wages. If efficiency and production keep pace with shortened hours, they can demand no greater wage, expressed in terms of purchasing power. If, however, despite the shorter work day or week, they produce more, the purchasing power of their wages will also increase. It is obvious that the same principle should apply to agricultural production, and that we should give our best thinking and effort toward reaching that condition.

But, whatever the relative purchasing power or barter value of agricultural and non-agricultural commodities and services, we must accept a shorter day and shorter week of work. We do not wish to accept this at the price of lower standards of living, and this brings us to one of the major problems concerning this nation. We are faced with the need of making more intelligent and adequate provision for such adjustments as will keep us in line with growing production and organization efficiency. We have come to believe that we shall see more and more decentralization of industry and of population. We shall see a greater equalization of comforts, conveniences and standards of living as between the farm, the village, the town and the city. We shall see an effort to raise

standards of living through the use of the leisure hours of the worker in commerce and industry for the purpose of producing a portion of the family's food supply from land owned or controlled by such workers. Undoubtedly, this is the reason why we are hearing more and more about part-time farming. If the principle of part-time farming is sound, the movement is certain to grow, perhaps to astonishing proportions. If this happens, what will become of our great cities? How will it affect the movement of our population? We shall have to think of the entire matter in terms of housing, water supplies, sewage disposal, light, heat, power, education, recreation and many other questions of major social significance. Shall we be obliged to look forward in the Northeastern States to new types of organization and procedures in agricultural production? Let us consider in greater detail some important facts about commercial and part-time farming!

COMMERCIAL FARMING

Many people feel an instinctive objection to long-time planning. In some measure, at least, there is good reason for objection to such planning. On the other hand, no worth-while enterprise can be organized and maintained without a careful analysis of the basic facts pertaining to that particular enterprise. Rational planning is a fundamental necessity for the success of any economic and social undertaking.

If we are to deal in a more rational way with agricultural progress, we should give more thought to the essentials of the production of our major crops. We should consider, in the first place, the geography of production. We know, for instance, that certain climatic and soil conditions are required for the production of wheat. Land that is reasonably level, a rainfall of at least 25 inches, a suitable range of temperature, and soils not too light in texture represent some of the prerequisites of successful wheat production under existing economic conditions. If we are to compete with the wheat fields of South America, Canada, Australia, Russia, and Roumania, we must provide a maximum labor efficiency, and that can be done best through the use of power machinery. At the present time, relatively little plant food is supplied by wheat growers in the countries just named. When the virgin fertility of these regions has been depleted to a greater extent, the production costs will be modified, and, with them, the extent of wheat growing in different localities. Evidently, therefore, the fundamentals of wheat production will need to be more clearly understood than they now are. A better basis will then be provided for the planning of the needed acreages and their location.

The same reasoning will apply to cotton. Also this crop will be produced on reasonably level areas, and on fields of larger size, to the end that power machinery for the fitting of the land, the planting of seed, the cultivation and harvesting of the crop may be carried out most economically. We know, even now, where our cotton crop can be produced most effectively, with soil and rainfall conditions, and the control of insects and root rot properly accounted for. Much the same procedure may be followed in planning for the production of corn and hogs, of beef cattle, sheep and dairy animals. We may use the same method in dealing with the production of milk and other dairy products, of tree fruits, small fruits, potatoes, sweet potatoes, beans, green vegetables, etc.

It is reasonably certain that the land will be called on to provide an increasing volume of certain raw materials for the manufacture of cellulose products,

starch, alcohol, organic acids, plastics, etc. Such industrial raw materials should be produced where their cost would be least. In this connection, we should bear in mind that the length of the growing season is an important economic factor. Thus, the pasture season for domestic animals will range from a few weeks in the extreme north to practically twelve months in Texas, Louisiana and Florida. Everything being equal, the longer the growing season, the greater the yield per acre. By the same token, there is also a greater drain on the plant nutrients, directly through utilization by the crop and indirectly through erosion and leaching.

Aside from location, we should consider carefully the organization of production. The quality of the soil, the kind of machinery to be employed, the amount and cost of power available, the processing of the crop or portions of it, the utilization of by-products, storing, transportation, merchandizing and sales control, all enter into the picture.

Since commercial farming is definitely competitive in character, the planning of a more efficient agriculture must involve coöperation both in production and selling. Questions as to financing, taxation, standards of living, and other factors are a fundamental part of the problem. We may also consider in this connection the questions of zoning, regional or national production control, the dealing with crop surpluses, and export markets. Thus, we find that we must anticipate rather far-reaching changes in the location of production areas, the organization of production and the storing, transporting, and merchandizing of staple crops. The Northeastern States have a contribution to make to this program. Not alone New York and Pennsylvania— which were at one time the granaries of the young nation—but also the New England States, New Jersey, Delaware and West Virginia, cannot escape their responsibility in land-use planning as related to commercial farming. Their concern with market milk production creates for them also a vital interest in forage and grain crops. There is also the possibility that, under modified conditions, they may find it profitable again to carry a larger proportion of meat animals. At any rate, the further expansion of part-time farming which may be anticipated need not be in the way of the rationalization of commercial farming in the Northeastern States.

PART-TIME FARMING

Part-time farming cannot be detached from other economic enterprises. Persons engaged in part-time farming may be employed in industry or commerce, in professional work, or they may be drawing part of their income in the form of pensions, interest on investments, or otherwise. For the reasons just given, part-time farming areas must be located where outside sources of income are most available. There was a time when our cities were, in fact, large villages, within whose limits vegetables, fruit, eggs, poultry meat, mutton, and other food products were produced. For economic and sanitary reasons, the pattern of our cities was gradually changed. The suburbs reached out further into the open country as the means of transportation and communication were improved.

In considering the future of part-time farming, we recognize that vegetables are the first source of food. Beyond that, the part-time farmer may keep a small flock of chickens sufficient in number to supply eggs for the table, and likewise some poultry meat. With more land at his disposal, he may keep small meat animals, such as rabbits, or he may provide for one or more brood sows. If still more land is to be had, one or

more cows may also be maintained by the part-time farmer. Obviously, part-time farming, like commercial farming, is quite flexible as to its limits. None the less, the part-time farmer considers the products of his land as a supplement to the income provided from other sources.

Various expedients may be resorted to by the part-time farmer for the sake of increasing his income. There is no doubt that his food supply may be more adequate by the processing of some of his produce. He may coöperate with his neighbors in disposing, at roadside stands or otherwise, of some of his crop surpluses. He may develop some rural crafts which would provide him with additional income. He may even attempt the growing of fur-bearing animals.

It is obvious that much may be said for part-time farming on the score of social as well as of economic values. It has been said that France has been able to maintain relatively stable political and social conditions because of the fact that a large portion of its population has a stake in the land. Any nation that can develop the fact and feeling of land-ownership in a substantial proportion of its population is to that extent assured of greater political and social stability. The family that owns its home and some land is not so easily influenced by the arguments of the radical agitator who would provide more income for the shiftless and the incompetent at the expense of the thrifty and the industrious. Part-time farming may be a means toward lessening delinquency and crime. On the positive side, it may be the means of helping our youth to understand better the meaning of culture and of the conservation of our natural resources.

FORESTS

Effective land-use planning is not possible without provision for the growing of forest and shade trees. The great hardwood forests of the Northeast have largely disappeared. While they cannot be all fully restored even in favorable locations, planned use of our land should reckon with the setting aside of

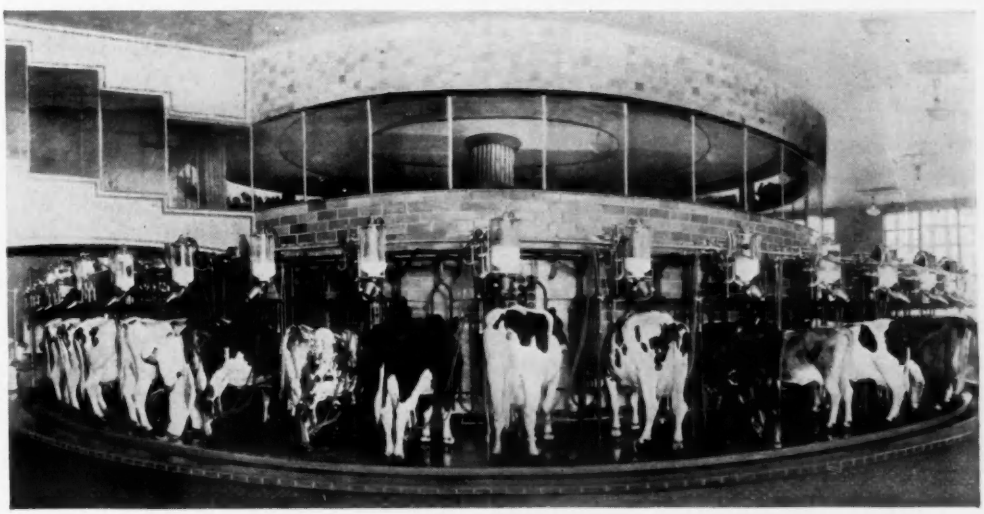


FIGURE 5.—The dairy industry of New Jersey, like the truck and fruit growing, has been very much intensified, in response to the effective demand from neighboring large cities and population centers for high quality of merchandise fresh from the producer. Only high prices for their wares would justify the dairymen in equipping themselves with such expensive, though effective, means of production, as this rotolacter indicates.

areas which should be kept in forests. These areas should become the source of an adequate supply of timber. At the same time, they should also be regarded as the conservators of wild life and the source of game animals and fish. They should be so managed and developed as to give us the most effective control of floods and the conservation of areas subject to erosion. In planning the use of land from the points of view of commercial farming, part-time farming, forestry, recreation, and flood control, we should not lose sight of the importance of certain adjustments in youth training and education. Sooner or later, rational land-use planning will point the way to a rural-urban civilization which is to displace our present urban-rural civilization.

THE USE OF LAND IN THE NORTHEASTERN STATES

Land use in the Northeastern States is a regional rather than a local problem. By way of summarizing what has already been said, we may note the need of considering crops and cropping systems both from the standpoint of commercial and part-time farming. We shall need to consider a well-balanced recreation program, which will involve the utilization of forest areas, state parks, local parks, lakes, streams, and ocean beaches. We shall be obliged to give due consideration to the volume and purity of our water supplies. The extent and nature of pollution, particularly by trade wastes, is even now a matter of pressing economic and social importance. The building of reservoirs, the establishment of sewage treatment plants and the encouragement of water sports are all a part of our water supply problem. We may also think of areas to be reserved for residential sites and their location in respect to water supplies, recreation areas, transportation lines, etc.

Finally, we shall need to consider the intensification of production so that the carrying capacity of our land may be increased to the economic maximum. Together with that, we shall pay due heed to the quality of the produce, so that animals and man may not lack the optimum amounts of calcium, phosphorus, nitrogen, manganese, iodine, copper, and other ingredients that are required for sound physical development. We may look forward, with a sense of security and optimism, to a future which promises to give us higher standards of living, greater freedom from exhausting labor, fuller opportunities for cultural development, and greater satisfactions that are the result of bodily vigor and mental tranquillity.

AGRICULTURAL REGIONS OF ASIA

PART VIII—MALAYSIA

Samuel van Valkenburg

THE numerous large and small islands southeast of Asia possess a remarkable fascination for the average man as well as for the scientist. Here were laid the scenes of many tales of adventure, by such authors as Jack London and Robert Louis Stevenson; here the emerald green islands rising out of a deep blue tropical sea set the stage for tales of murder and piracy. Quiet restful cities like Macassar and Palembang still retain their old reputation as centers of crime and mystery.

Less fantastic and more real is the interest of the scientist. The geologist finds the region a classical example of structural processes in full swing: islands rising above the ocean level, while deep basins are forming and active vulcanism and earthquakes are visible signs of the stresses rending the earth crust. The biologist finds here not only profusion of equatorial vegetation, but the transition between Asiatic and Australian life. The famous lines of Wallace and Weber mark stages in the development of these biological realms.

The anthropologist traces the migrations of racial groups from Asia into this island world and the South Sea; he studies remnants of primitive races in the sanctuaries of mountain jungle, and analyzes the various racial elements of the present so-called Malay population. The archaeologist, more concerned with culture, discusses the various influences from India, China, Arabia, and, in later centuries, also from Europe and America, which found their way into the life of the natives, modifying it, but finally becoming only an element in the adjustment to tropical environment. The historian investigates the interplay of the ancient political influences of India and of China, at the Strait of Malacca as point of junction; he follows the explorations of the Spaniards and the Portuguese, of the English and the Dutch, and the subsequent founding of colonial enterprises and empires. The statesman is interested in the problem of colonial structure and the present desire for more political freedom; he sees Malaysia as a focus of many political interests, as a white man's bulwark against the seething Asiatic tide.

Finally, the geographer finds it one of the most fascinating complex of problems in his field. Malaysia is an exception to the general rule that equatorial regions are culturally as well as economically backward and unimportant. The magnitude of population figures—65 million—shows that man is not necessarily subject to tropical disadvantages and has responded successfully to the challenge of nature.

Even more interesting are the contrasts between the economic intra-insular development of the various subdivisions. Maps of cultivated land and distribution of population (see later) reveal striking concentration of human activity in a few regions: Java, parts of Sumatra, the Malay Peninsula, Celebes, and the Central and Northern Philippines. Java ranks first among them all, far and away the most populous. On Java, with a population of 40 million, native, as well as estate, land utilization has reached a degree of intensity unknown elsewhere in equatorial regions.

This study presents an explanation of these contrasts. Why are some regions much more developed than others, and why does Java rank so high above the other better regions? A general outline of the general physical environment and the vegetation precedes the general treatment of land utilization. A more detailed description of the more advanced sections will follow—the Malay Peninsula, Sumatra, Java, parts of Celebes, and the Central and Northern Philippines with special reference to Luzon.

The name Malaysia used as title for this instalment of the Agricultural Regions of Asia needs some explanation, because the area here discussed goes beyond the real Malay sphere of influence, which is moreover in many cases limited to the coastal regions. Still the name has decided advantages, especially if the racial kinship between Malays and Filipinos is taken into consideration. Only east of Celebes and the Little Sunda islands enters the geographer another — non-Malay — world which shows clearly the influence of the Australian continent. Nevertheless, this section has been included because of its physiographic affinity and because it was not included in the preceding publication of the Agricultural Regions of Australia.

General Bibliography

Of the great number of publications on Malaysia only a few need be mentioned here as of general interest. The literature dealing more exclusively with British Malaya, Sumatra, Java, and the Philippines will be mentioned in connection with their more detailed treatment. The best book in English on relief and structure is that by Dr. H. Albert Brouwer, Netherlands exchange professor to the University of Michigan, entitled "Geology of the Netherlands East Indies." For climate the numerous publications of the Meteorological Institute (Koninklyk Magnetisch en Meteorologisch Observatorium) in Batavia give a perfect picture of climatic conditions and make it almost the best known climatic region of the world, while the Weather Bureau at Manila has been especially known for its study of typhoons. An excellent résumé of all climate conditions of Malaysia is given by Dr. C. Braak in "Klimakunde von Hinder Indien und Insulinde" belonging to Koeppen's "Handbuch der Klimatologie" (Borntraeger Berlin, 1931).

As regards vegetation, the several statements of the vegetation on Malaysia in the many general handbooks on plant geography are rather vague and often untrustworthy. An excellent treatment is given in a series of articles in the Netherlands periodical "Tydschrift von het Aardrykskundeg Genootschap" by C. G. G. J. van Steenis in 1935, an explanatory discussion of the plant geographical map of plant distribution which is part of a new official scientific atlas of the Netherlands East Indies, an article which should be translated into English, for its very valuable and otherwise unobtainable material.

Publications on land utilization and agricultural statistics of the departments of agriculture and statistics of the various governments (for Malaya, Kuala Lumpir, for the Philippines, Manila, for the Netherlands East Indies, Batavia, for statistics and Buitenzorg for agriculture) are valuable. Many articles containing local information have been published in various magazines, most of them in the Netherlands language. One deserves mention, namely, "Native Agriculture" (De inlandsche landbouw in Nederlandsch Indie) in the Tydschrift von Economische Geographie," 1926. Valuable, although very general, is the "Hand-

book of the Netherlands East Indies" (in English), Department of Agriculture, Industry and Commerce, Buitenzorg, Java, 1930.

RELIEF [1]

The base for the understanding of the structural features of Malaysia is supplied in Map 1. Two shelves, the Sunda Shelf and the Sahul Shelf, both submergence with submarine troughs still representing the former continuations of the river valleys on the surrounding islands. The flatness of these coastal lowlands, where natural levees flank the winding river courses, favors the development of interior swamps, while mangroves border the coasts and form a natural barrier against marine encroachment. Malaria and other tropical lowland diseases hamper human occupancy, which is in most cases limited to the river levees and the river outlets, practically the only entrances to the hinterland. Coastal soils are leached and waterlogged; the mountains in their dense forest cover are too far inland and too inaccessible to become favorable areas for human activity. The unstable part between, and along, the more stable shelves also offers dis-

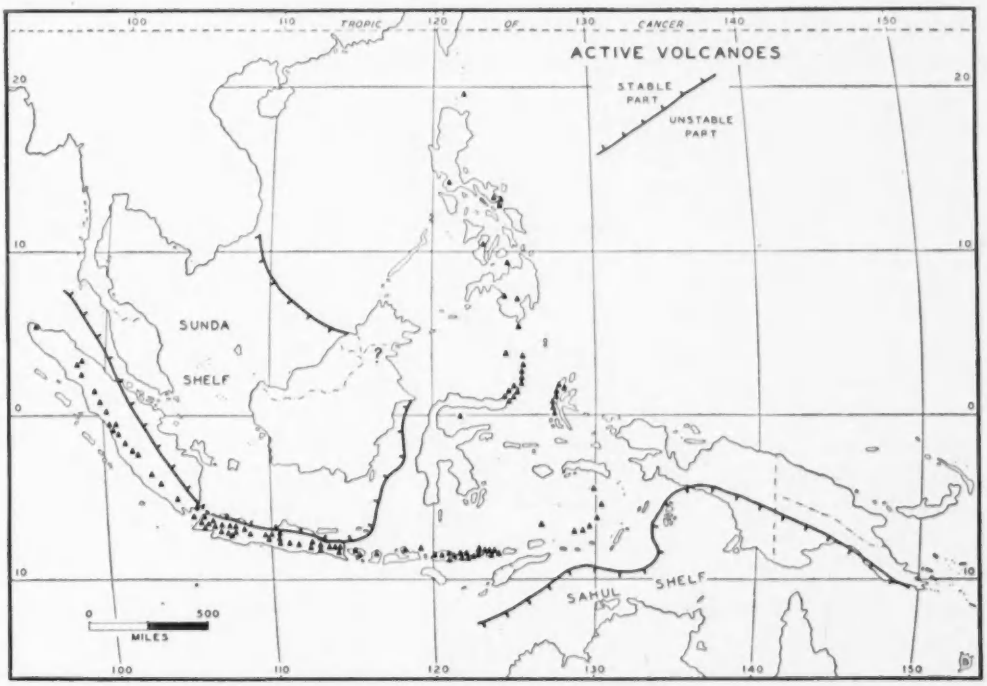


FIGURE 1.—Between the great stable Oriental massif of southeastern Asia and the equally stable Australian massif, intervenes an exceedingly unstable realm of structural deformation, vulcanism accompanied by earthquakes, and constant adjustments in the earth's crust with consequent changes in the contour of the land and the profound basins intercircled by the groups of islands. The effect in the human occupation and activities of this region are wide-spread and impressive.

continuations of the respective continents Asia and Australia, oppose an intermediate belt of structural instability. The shelf areas, being the stable part of the archipelago, comprise old eroded mountains and uplands bordered by extensive alluvial plains which merge into the very shallow interinsular seas. The South China-Java Sea and the Arafura Sea show evidence of recent

[1] For names, see Map 8.

advantages. Young mountains rise abruptly from the sea, leaving little space for the formation of coastal plains; the sea bottom drops precipitately to great depth. Heavy rainfall and torrential wash and streams have dissected the mountain slopes into a rough topography which, if deforested, is subject to the hazard of landslides. The result is that man finds unfavorable conditions for advanced agricultural activities, and his cultural standard is correspondingly low. The rising coast lines show in general few indentations, and with few exceptions natural harbors are rare. Ships must anchor on the open roadsteads, while the fishermen have little refuge when the monsoon winds are blowing. Nevertheless, the sea with its abundance of fish is often more attractive than the unhospitable land; the Malay population is adept in the art and practice of navigation.

Still, favorable local circumstances can improve conditions for human occupancy considerably. Along the zone of contact between stable and unstable regions, as in northeastern Sumatra and northern Java, shallow sea conditions favor the formation of a coastal plain; a slight uplift removes the disadvantages of stagnant drainage and makes the plain ideal for human use. Another advantageous factor is the prevalence of volcanoes, many of them active and frequently eruptive. The map shows the location of active volcanoes in long ranks through the unstable part, following the main trend of structure. The many non-active volcanoes are omitted but would show the same general distribution. Volcanic deposits yield young fertile soils and in many cases connect formerly detached land units into larger islands, with lowlands between the former sea-washed mountains; in other cases intermontane basins, formed between volcanoes, have become spots of high fertility and an excellent base for an advanced type of rural economy. Thus, while volcanoes have locally become a blessing, especially in Java and on many of the Philippines where regular-shaped volcanic cones rise out of the extensive lowlands, on other islands their influence is far less beneficent. In most of Sumatra, volcanoes crown relatively inaccessible mountain ranges, while in the Moluccas they rise steeply out of a deep sea without chance for a coastal plain. Summarizing, it can be said that both stable and unstable parts show decided disadvantages to human occupancy. Under special circumstances the unstable part, thanks to the influence of adjacent stability and of vulcanism, can offer locally conditions which are almost ideal for higher development of mankind if the climate permits it.

GENERAL DESCRIPTION OF RELIEF

The following short description will bring out the main relief features, serving at the same time as an orientation of the constituent parts of this rather complex part of the world. Map 2 is the base for this description while the names may be found on reference Map 8.

The Tenasserim ranges of Farther India discussed in the third instalment on the Agricultural Regions of Asia, extend southward to become the backbone of the Malay Peninsula. The range is not continuous; it shows a sequence of ranges in "en echelon" order in a general north-south direction. This explains the rather easy passages between the ranges. One of these forms the Isthmus of Trang, which may become in future the spot for a canal between the Gulf of Bengal and the South China Sea, detaching the whole peninsula.

Lowlands border the coasts, especially along the commercially famous Strait of Malacca. These Malay ranges con-

tinue through the Riau Archipelago and the tin islands Banca and Billiton and seem to find their logical extension in western Borneo, where they continue to the central mountain core.

The Arakan Yoma, the western range of Burma, can be followed southwards over the Andamans and Nicobars and then forms the mountain backbone of the two large Sunda islands, Sumatra and Java, while a second fold towards the west is broken up in several islands which parallel the Sumatra coast. Nias is the best known of these islands.

The dorsal mountain system of Sumatra exhibits dual character. The western range, called Bukit Barisan, which is continuous, leaves only space here and there for a narrow coastal plain. A rift valley with many structural lakes bordered by many volcanoes separates the Bukit Barisan from the eastern mountains, which show the same "en echelon" tendency as the ranges of the Malay Peninsula. Several ranges strike out eastward amid the coastal lowland. Large, sluggish rivers, fed by the heavy mountain precipitation divide the plain into several units. Physiographically a higher, older, rolling relief in the western part (a kind of piedmont) contrasts with the level, swampy eastern part, where the natural river levees are in many places the only suitable spots for human settlement. Sunda Strait, with the famous volcano Krakatau, is located at the bend of the Sunda Range which continues through Java, running there from west to east. The mountains rise generally steeply from the Indian Ocean, providing, except in central Java, no opportunity for the formation of a coastal plain, while along the north side of Java lowlands of varying width are always present. Volcanoes are numerous, located along

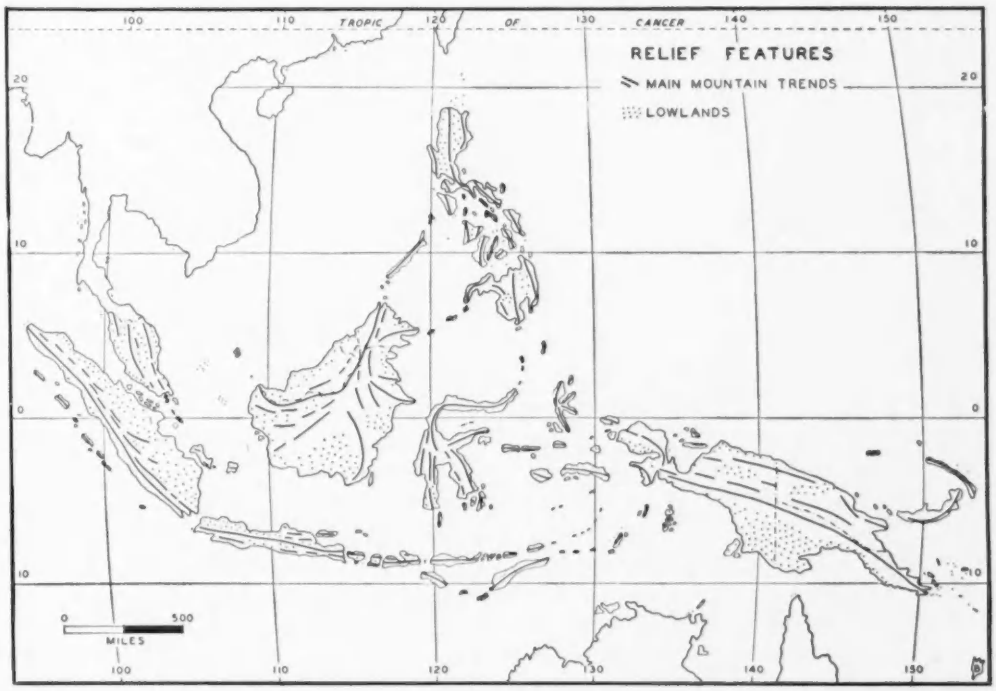


FIGURE 2.—The essential elements in the relief, consequent upon the instability of the earth's crust, are the extensive skeletal mountain ranges upon the flanks of which lie lowlands of considerable extent near the stable massifs, and smaller, wellnigh negligible, lowlands in the heart of the unstable regions.

structural lines of weakness. In western Java they form continuous lines, including between them intermontane basins, while in the east they have a more individual development, rising up from the low topography and connecting formerly far-extended anticlinal islands into one land mass. Only Madura shows still the character of a rolling landscape of limestone ridges. The Sunda fold continues eastward along the Lesser Sunda Islands. Bali resembles Java in combining volcanoes with a topography favorable for human use. Lombok has a fertile central lowland between the northern and southern ranges, but the other islands (Sumbawa, Flores) are rather mountainous and leave little space for lowlands. Sumba and Timor, which are on a separate fold south of the main Sunda Range and include between them and Flores the Savu Sea, present more favorable conditions. Their emergence from the sea is abrupt and steep with beautiful, local terraces indicating periods of uplift. But once on top, much of the topography consists of rolling uplands, while the open vegetation—a response to dry climate, facilitates crop agriculture and stock raising.

This double range system continues in the great structural island arch around the deep Banda Sea. The outer ring, non-volcanic, includes the island groups of Tanimber and Kai, all of them economically unimportant. Also the large islands Ceram and Buru have still little influence on world production; better known are the Ambon group just south from Ceram, an ancient stronghold of the Dutch East India Company, producing cloves and nutmeg. The volcanic inner row comprises small islands, the last one, Banda, being one of the famous islands of spice, which once brought the European explorers and merchants to this region.

The large island of New Guinea, the second largest island of the world—if Greenland be considered first—shows in its general relief a zonal arrangement. The southern lowlands border the shallow Arafura Sea and are flat and swampy. The central range, the Snow Mountains, rises steeply from these southern lowlands and extends, as the name indicates, in some spots above the snow line. The main chain is followed to the north by several parallel ranges of less elevation. An interior lowland, formed by two river systems, the Mamberamo and the Sipik, separates the central mountains from the coastal ranges which reach their highest elevations in the Huron Mountains in the extreme east. The western extension of the central ranges of New Guinea is rather complex. Bending northward to the so-called "bird's head" of New Guinea —the Northwest Peninsula—the continuation may be sought along the Obi and Sulu islands towards Celebes as well as farther north to Halmahera. This last island, also revealing recent vulcanism, especially along the western bordering islands of which Ternate is well known as the spice center of the Moluccas, represents the point of virgation of different mountain lines of which the eastern one can be followed along the great arc of Palau and Yap and finally the Bonin Islands to the Fuji chain of Japan.

In a remarkable way the island of Celebes presents the same shape as Halmakeira. Here also the different mountain axes radiating from a central upland core can be structurally continued along the neighboring islands; the Salayer group in the southwest, Muna and Buton in the southeast, and the double series Sangi-Talaud in the north.

Borneo also seems to be the expression of radiating mountain ranges but

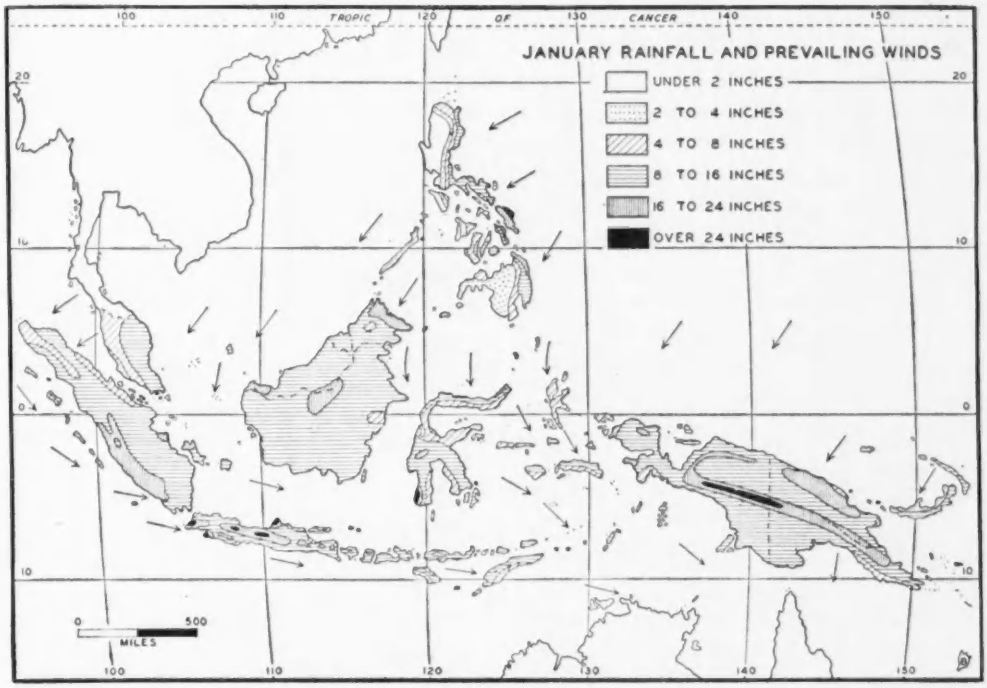


FIGURE 3.—The varying conditions of rainfall over Malaysia in January reflect the character and direction of the winds as they are determined by the interplay of Asiatic, Australian, and equatorial influences. (After Braak and Boerema.)

of an older period. Large lowlands have been formed between those ranges. The principal are the Sarawak coastal plain and the three great river basins, the Kapuas in the east, the Barito in the south, and the Mahakam in the east.

Four anticlines appearing in the form of rows of islands and submarine ridges combine to form the complex relief of the Philippine Islands. Two of these have been mentioned as extensions from Celebes; the others are the Sulu Islands and Palawan. Mindanao is the product of three of those anticlines, with lowlands extending between the ranges. Luzon shows similar features. In the north the Cagayan depression is located between the Eastern and Central Range, while northwest of Manila another depression separates the Central Range from the Zambales Mountains.

The islands between Luzon and Mindanao are the disconnected remnants of the structural connection between the two large islands. All of them have north-south mountain backbones. Samar represents the most easterly range, succeeded westward by Mascate (a product of junction of two ranges), Leyte, and finally Panay and Negros, with Cebos and Bohol as intermediate mountain islands. Except for Luzon, Mindanao, and Panay, extensive lowlands are absent and only narrow coastal plains border the coast here and there.

On the whole it can be said that except for the continental shelves, a mountain topography prevails, the result of recent structural processes still active. This is shown not only by the large number of earthquakes which make this one of the most seismic regions of the earth, but by the frequent violent volcanic eruptions.

CLIMATE

The climate of Malaysia is the result of the interplay of several factors: (a) the location between two continents with the resulting exchange of air masses (monsoons) from the summer low pressure to the winter high pressure; (b) the equatorial latitude with the high sun and tendency to convection; (c) the insular character which causes generally moist weather (except when desiccating winds prevail), no extreme heat, and the advantages of coastal sea breezes during the day.

While the monsoon winds are steady with a maximum velocity over the sea of 4–5 Beaufort scale, really strong winds are practically unknown, except for some local squalls, which are typical for the Strait of Malacca, for example, and nature has been adjusted to these calm conditions. An exception must be made for the Philippine Islands north of ten degrees north, where typhoons appear in fall and can be very destructive.

Temperatures are uniform; night temperatures in the low seventies (except in the periods of transition mentioned later) and day temperatures in the high eighties, but almost never nineties. The cooling influence of afternoon showers is missed greatly during the dry season but is compensated for by lower relative humidity and by stronger radiation during the nights. Typical also are the great number of thunderstorms, which reach in the station Buitenzorg, south of Batavia, the world maximum of an average of 322 thunderstorm days a year. Temperatures show little seasonal variations; only the most northernly stations in Luzon show a decided winter decrease. Decrease follows with rising elevation and mountain resorts up to 6,000 feet offer suitable conditions for recuperation from the lowland heat. On clear nights frost forms on mountain tops with an elevation of 10,000 feet or higher and may happen even much lower in some ill-drained basin, in which cold air accumulates. Snow falls only on the Snow Mountains of New Guinea and there above 16,000 feet are a few small glaciers. Precipitation is the great weather element which in amount and distribution is a major control of land utilization. An explanation of conditions of precipitation will be given in the following description of climatic seasons.

The climate of Malaysia can be divided into four seasons, two long and two short. The two long seasons correspond to the regular summers and winters of more temperate latitudes and are separated by two relatively short periods of transition. The following months are taken as typical seasonal representatives: January, April, July, and November.

January (see Map 3)

From the continental high pressure area of Asia, issue winds which, deflected towards the right, rotate clockwise. In Malaysia north of the equator they become northeast winds which merge with the regular trades. These winds decrease in velocity while passing over the equator, but gain again southward when they blow as northwest winds towards the Australian summer low. The northeast monsoons north of the equator are relatively dry, moving from colder to warmer temperatures but they have picked up sufficient moisture while passing over the ocean to cause orographic rain when forced to rise, for instance on the east coasts of the Philippine Islands, in North Borneo and East Malay Peninsula, the mountains of North Sumatra, the north coast of Northeast Celebes, Buru, Ceram, as well

as New Guinea and the Bismarck Archipelago. Located on the leeward side, with correspondingly dry conditions, are the western part of the Philippine Islands, the western part of the Malay Peninsula with the opposite Sumatra coast as well as the northern Sumatra rift valley. Relatively dry also are the south coasts of the corresponding wet northern coasts, which have just been mentioned. The equatorial sections of Sumatra and Borneo have the regular convectional equatorial rain, while the monsoon over this larger land mass has slowed down so much that it does not interfere greatly with heat convection. The western winds south of the equator finally are moist and not only cause heavy orographic rain when forced to rise (mountains of west and central Java, west coast of southwest Celebes) but give general moist atmospheric conditions with convectional afternoon rains. This is the rainy season for Java, the Lesser Sunda Islands and the southern New Guinea lowlands.

April

During the transition period, unstable wind conditions prevail. The equatorial regions with the sun at the zenith have a rain maximum. The newly established Australian high pressure emits southeast winds, which do not find the favorable isobaric gradient towards the Asiatic low and piling up, rise near the equator increasing the equatorial rainfall on the Australian side. The weather on both sides of the equator is generally sultry and unpleasant lacking the advantages of the dryness of the so-called dry monsoon with its cool nights and the refreshing showers of the rainy season.

July (see Map 4)

The July conditions of precipitation are contrary to those of January. The winds blowing out of Australia are dry causing arid conditions in the Lesser Sundas, south New Guinea, most of southern Celebes, and Java. Orographic precipitation is caused by a forced rise especially on greater distance from Australia, when the originally dry air masses have picked up moisture from the warm bodies of water over which they passed. This orographic rain is well illustrated on the map on the mountains in central New Guinea, on three spots of Celebes, and on the volcanic southeast-facing mountain slopes of some of the Sunda islands, especially in east and central Java. West Java, although having its dry season, has still considerable precipitation due to relief and greater distance from Australia. Rain shadows are well developed on the leeward side of the mountains with orographic rain on the windward side. The equatorial sections of Sumatra and Borneo have convectional rain but much less than in the period when the sun is at zenith. The inblowing Asiatic monsoon winds, the southwest monsoons, are moist and bring general rainy conditions north of the equator and heavy orographic rain on some of the western mountain slopes, for example on Luzon. Rain shadows develop in northwest Sumatra and its rift valley and in the eastern sections of the Philippine Islands.

November

November is very much like April, with heavy convectional rain on the equator and sultry weather otherwise. The outblowing air masses from Asia do not find favorable barometric conditions over the equator towards Australia and consequently are forced to rise upwards increasing in that way the already heavy rains on the Asiatic side of the equatorial section. Cyclonic disturbances often developing into ty-

phoons appear over the Pacific Ocean and the South China Sea north of ten degrees north bring downpours of rain to the northern Philippines, especially to the eastern coasts.

Yearly Precipitation

Map 5 shows the yearly rainfall. From the economic point of view only those regions with a precipitation of less than 80 inches and especially those under 60 inches are of interest. The areas of low rainfall (from the point of view of rainfall efficiency) are limited in size. Included are part of the northern lowland of west Java and larger parts of east Java, most of the Lesser Sunda Islands, especially Sumbawa, Flores, Sumba, and Timor, the south coast of New Guinea, parts of Celebes and considerable portions of the central Philippines and Luzon. The driest spot of Malaysia is the narrow Palu Valley in the western part of central Celebes. But most of Malaysia receives abundant precipitation which in some stations attains 30 feet average a year.

Climatic Regions (Map 6)

The climatic regions are principally based on the evaluation of the seasonal distribution and can be easily understood from the preceding description. A comparison with the later discussed maps of land under cultivation (Map 7) and distribution of population (Map 8) indicates clearly that those regions with a short dry season (Koeppen Am climate) provide the most favorable conditions for human occupancy. These are Java, most of central and northern Philippines (except the east coast) as well as southwestern Celebes. Southern New Guinea, also with an Am climate, is an exception because of swampy lowland conditions. The Lesser Sunda islands (except Bali and Lombak) outside the mountain regions suffer from aridity (Aw climate), while the same is true for a limited area of the Philippines. The equatorial regions endure the disadvantage of no dry season (Af climate). But it is worth while to note that the regions with a higher economic development (western Malay States, northeast Sumatra, and parts of south Sumatra) have a dry season, although not pronounced enough to be shown on the map. The Padang Highlands and the Minahasa in eastern northeast Celebes have the advantages of cooler temperatures due to elevation.

Summarizing, it may be said that relief and climate favor the same sections of Malaysia and are together responsible for the great contrasts in economic and cultural level.

NATURAL VEGETATION

Heavy rain well distributed over the year, and warm temperatures, favor dense luxurious tropical vegetation. Much has been written about the equatorial hardwood forests where the traveler laboriously finds his way through mud and roots in the semi-darkness under the thick roof of leaves. Above in the sunlight are the blossoms and orchids; there are the brilliantly colored birds and the chattering monkeys, but below is the silence broken only by the falling water drops.

The composition of such a forest is very complex; pure stands of one type of tree are rare and the economic value of the forest is greatly decreased by the difficulty of getting out of it a valuable timber or other forest product from a profusion of other plants and trees. Still a certain arrangement of forest structure can be recognized. Generally a forest consists of different layers; a ground level of vegetation is generally missing, but a layer of high scrub is topped by one or more crown roofs.

Then changes in topography and soil, the conditions of the forest base, wet or dry, permeable or impermeable, have influence on the forest composition while the zone of light along the river beds favors special types of vegetation.

The physiognomy of the forest changes with elevation. At about 6,000 feet the trunks become gnarled and thin and are covered with mosses; the "Nebelwald" (mist forest) as the Germans call it, prevails. Above 8,000 feet scrub replaces the trees. The climatic limit of forest vegetation is attained only on the Kinabula, the high mountain of British north Borneo, and the Snow Mountains of New Guinea, at an elevation of about 13,000 feet. On many of the volcanoes the crater cone consists of stones and ashes on which vegetation is absent. The equatorial alpine vegetation of New Guinea which extends up to the snow level, contains partly endemic plants adjusted to this environment, partly alloctthonous species affiliated with the alpine flora of Asia and Australia and probably remnant of a former different topography, which constituted a bridge from the high mountains of Asia and Australia to the spot now isolated. On the map (No. 7) the area of dense forests takes up most of the land not under cultivation, except for a more open type of vegetation in the regions with a pronounced dry season and a few similar sections in Sumatra and Borneo, due to secondary influences.

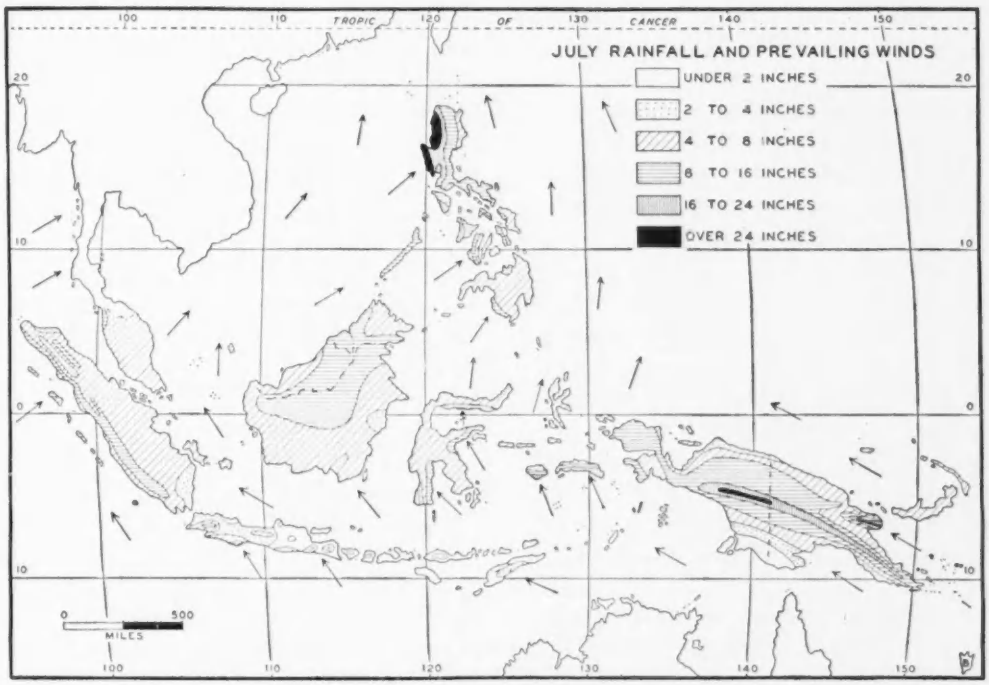


FIGURE 4.—The almost reversed conditions of rainfall in Malaysia in July as compared with January reveal the remarkable transformation produced by the seasonal change in the relationships between Asia, Australia, and the equatorial seas. (After Braak and Boerema.)

The dense evergreen equatorial forest with its great structural complexity nevertheless shows some typical tree species. In general, and this is especially true for the western islands, dipterocarp species prevail, for example

the diptocarpus, the shorea, and the hopea. The high agathis, a conifer, is more representative for the eastern part of the island world. The valuable sago palm covers large areas of swampy conditions in New Guinea and the Moluccas and also in the Riau Archipelago south of Singapore. Interesting is a pine tree (Pinus Merkusii) which is found in north Sumatra and in Luzon, where the forest is more open and forms a transition towards the savanna type.

Large sections of the equatorial forests are no longer virgin, but secondary; these are called "blukar" forests. Frequent fires, chiefly connected with the nomadic type of land utilization change the composition of the forests greatly and if conditions of climate and soil are favorable, may even replace the forests by a scrub or grass vegetation. This is typical for parts of Sumatra, where it will be discussed later in the detailed regional treatment, and of Borneo. A tough grass, the alang-alang is in many cases the essential part of the new vegetation.

The coastal vegetation shows the difference between swampy or dry soil conditions. Mangroves (see map) border flat coastlines, especially where silting takes place. The belt of mangroves is often succeeded by a nipapalm swamp in brackish water, but nipas form also tidewater swamps and replace the mangroves where living conditions for these are not favorable. On a dry sandy coast the "tjemara" (casuarina) forms a coastal belt. It is noteworthy that this tree appears again in the higher mountain regions; the same is true for the pandanus which grows along the coasts and rivers and also along the upper forest zone.

Savannas with a regular park landscape are a response to climate with a long, dry period and are limited to the corresponding climatic regions as a comparison between Map 6 and Map 7 shows. Here fires to favor the growth of grass for grazing purposes have done much to keep down the forest development. The extensive areas of teak (Malay djati) on north central and east Java, favored by a rather dry climate and limestone soils, show an open forest type and can be called monsoon forests as they lose their leaves during the dry season. A similar response to climate shows the pine forests mentioned before.

On the Lesser Sunda Islands, southwest New Guinea and parts of the Philippine Islands the open tree-grassland prevails; on the Philippines its share of the natural vegetation amounts to forty per cent. Eucalyptus is typical for some of the islands near Australia. Palm trees also do well, especially the lontar palm (Borassus flabellifer L.); typical is the scerophil succulent Opuntia Euphorbia; even the cactus appears in the dry Palu valley of central Celebes.

ECONOMIC USE

Timber

Except for the very valuable teak forests of the Isle of Java, which embrace almost two million acres under government control, and for the exportable timber of the Philippine Islands, the lumber value of the great forest region is surprisingly small, resultant in part from complexity of forest structure, already mentioned; in part also to the general damaged conditions of the wood, due to parasites; the rapidity of rotting under warm moist weather condition; and in part to the distance from the world market. Hence only fancy woods have export value, such as ebony, sandalwood, Amboynawood, ironwood, and the varied Philippine mahogany, for which many species supply their timber.

Locally timber is used for the building of the better types of homes, for

mine construction, for railway ties, and for furniture. Wood, as well as charcoal, for cooking purposes is used for fuel throughout the islands. Mangrove lends itself well to charcoal making. Rattan, a long climbing cane, found all through the forests from the coast wellnigh to the mountain crests, is used extensively for furniture and baskets. Bamboo, also, should be mentioned as invaluable for the needs of native life.

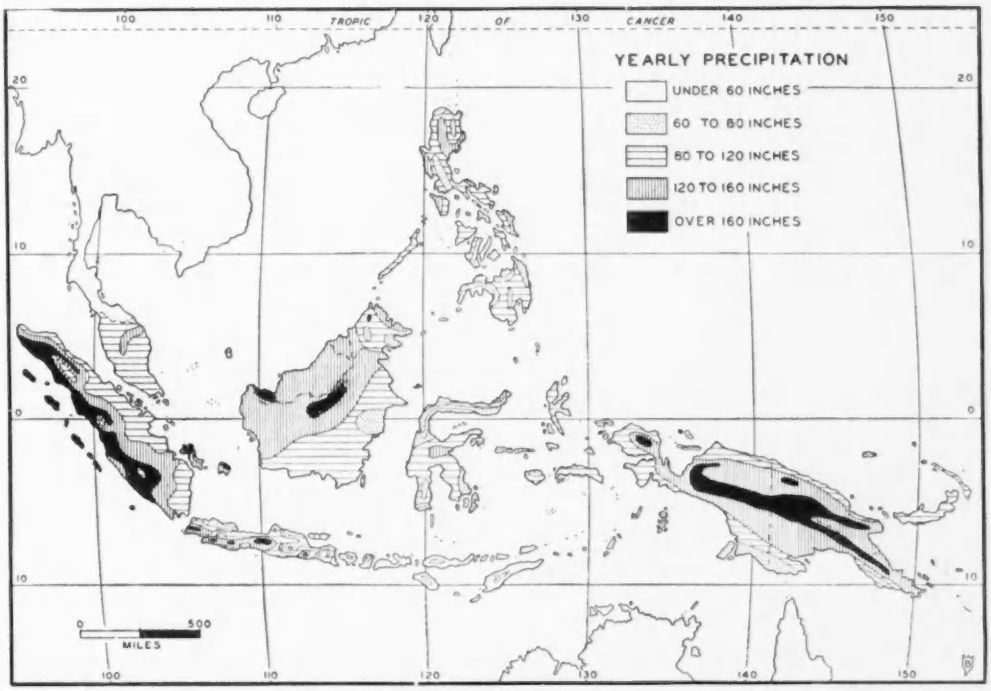


FIGURE 5.—The outstanding feature of the annual precipitation is the copious rainfall which almost the entire Archipelago receives for at least part of the year, and over much of the area throughout the year. The areas with less than 60 inches of rainfall a year are wellnigh undiscoverable. (After Braak and Boerema.)

Secondary Forest Products

Among the great number of forest products other than timber, several have attracted the attention of different world industries, and while others have only local use, they deserve being mentioned, nevertheless, because of their importance in local economy. The following list is far from complete, but contains the most important.

Sago. The marrow of the Sago palm is the chief source of food in many of the eastern islands and provides also in the western groups a welcome change from the general diet of rice and corn. It is used in different forms, varying from almost raw in New Guinea to a well-cleaned porridge in the Moluccas; the exported pearl sago is the ultimate refinement of this product.

Sugar. Sugar is obtained from many palm trees, of which two are of special value to the natives, the aren palm (Arenga saccharifera) and the Lontar palm (Borassus). The last one is found mainly in the drier southeast. Palm wine and alcohol are made from the palm sap.

Oils. Wood oils are derived from

several tree species. Well known is the Kajuputih oil, distilled from the leaves of the Melaleuca Leucadendron, which grows well on some of the dry southeastern islands. Oils are also obtained from the illipe nuts, in the form of a vegetable fat or tallow extracted from the fruits of several trees of the dipterocarp family and used in world trade as a substitute for cocoa butter.

Camphor. Camphor is generally known as a distilled product of the Cannomonum Camphora. But in Sumatra and Borneo another kind of camphor has obtained commercial value, namely the Baroscamphor, named after Baros, a coastal settlement in northwest Sumatra, which is found crystallized in hollows of a species of Diptocarp and is used for its medicinal value and for the embalming of Chinese dead.

Tannin. A tannin named "cutch" is made from the bark of mangroves and especially in North Borneo has commercial value.

Resins. Turpentine is a product of the pine forests (Pinus Merkusii) mentioned in the preceding description of vegetation. Two well-known resins are damar, an excretion of different Dipterocarps (the Shorea and Hopea families), and copal, a product from the Agathis Alba, a conifer. Also dragon's blood, a red resin from the fruit of a rattan (Daemonorops Draco) deserves mention. Another resin, benzoe from the Styrax Benzoin in northern Sumatra is used for making perfumes because of its pleasant aroma.

Rubber. Rubber, or as it was named first caoutchouc, is still in some sections obtained from the ficus elastica, a forest tree. But the great development in the growing of Hevea Brasiliensis has practically destroyed the wild rubber production. The Hevea, which is partly grown in plantations, will be treated under that heading later but the extensive rubber jungle of east Sumatra and parts of Borneo are already a transition between planned and wild production.

Gutta-percha. Once obtained almost entirely from the sap of the wild growing Palaguiem, most of it is now produced in estates where the gutta-percha is distilled from the leaves.

LAND UTILIZATION

General Description

Land utilization in Malaysia shows clearly different stages of land economy, ranging from the most primitive to the most advanced type of tropical agriculture. Sometimes only a relatively short distance separates these two extremes; this is the case for example in West Java where the primitive Baduj's in their mountain forests almost border the plain of Buitenzorg, which shows the highest development of tropical agriculture.

This general description, divided in two parts—*native agriculture* and *plantation or estate agriculture*—will be followed by a regional description of the agricultural conditions of some of the most productive parts of Malaysia, namely the Malay Peninsula, Sumatra, Java, parts of Celebes, the central Philippines, and Luzon. The reason for this selection is brought out through a comparison of Map 7, showing land under cultivation, and Map 8, showing distribution of population. This comparison brings out the fact that the special regions mentioned not only contain most of the cultivated land and most of the population, but that the cultivated areas of Borneo, the Lesser Sunda islands east of Lombok, most of Celebes and Mindanao have only a very sparse population, indicating extensive type of land use. The comparison shows also once more the outstanding position of Java, which will be adequately dealt with later.

Native Agriculture

Collective Land Economy. Collecting forest products—yams, fruits, honey—as well as fishing and hunting, as the only means of sustenance is still practiced in different parts of the Malay world. The Semang and Jukan on the Malay Peninsula, the Kubu's on east central Sumatra, Negrito tribes on Luzon on some of the other Philippine Islands, as well as certain mountain dwellers (Orang Buket) in Borneo still live mainly in that way. In their mountain forest environment they have kept aside from the intruder with higher culture. They represent the original response to the tropical environment, unmodified by new ideas brought from elsewhere. Their dwellings are primitive and temporary but are already regular homes and not, as was often supposed, forest trees. Many of the inhabitants of the eastern islands live almost in that same way, although their cultural level is much higher. The reason for this is the abundance of Sago palm, which prevented any desire for regular field work. The art of fishing and hunting with bow and arrow as well as blow pipe is well developed and settlements are permanent and better built.

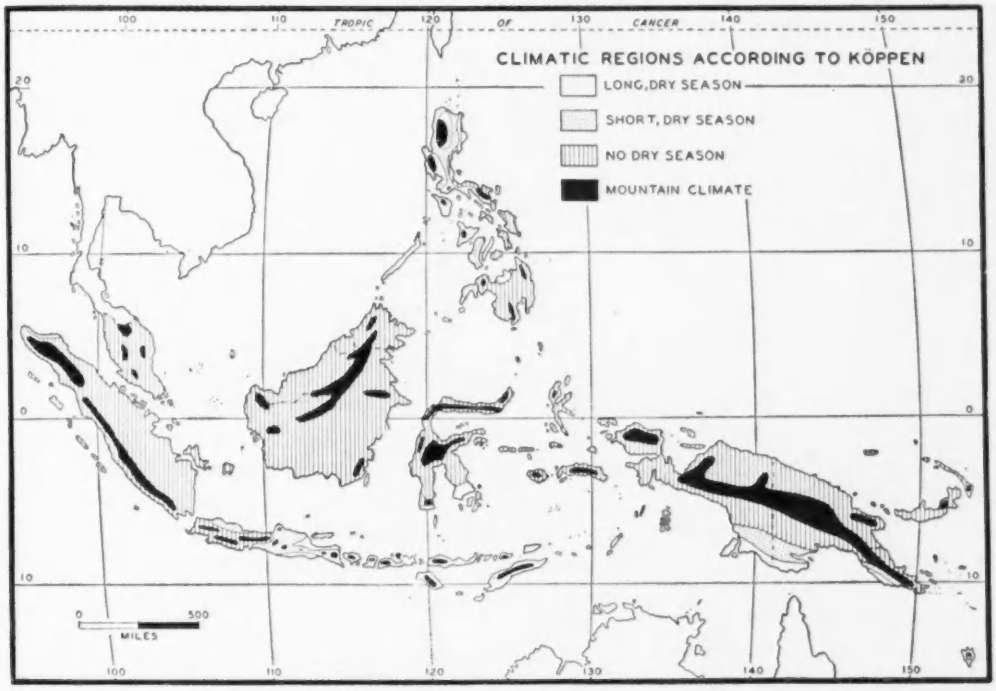


FIGURE 6.—By far the greater area of Malaysia is characterized by no arid season; only small areas by a short dry season; and even smaller areas by a long dry season. The areas of mountain climate constitute the regions where health and comfort for the European occupants are most likely to be found.

Milpa Agriculture (Malay "ladang"). Ladangs, open spaces in the forest due to the planned fires, are a familiar sight on the mountain slopes of Malaysia. Before the rainy season the smoke of forest fires over the mountains attracts the passengers on the coastwise steamers while some of the Lesser Sunda islands even make the impression of being totally aflame.

In general the process of planting is simple; with a primitive dibble—a

pointed stick—a hole is made in the ash-covered ground and the seed put in there; here and there the uprooting of the soil with sticks is practiced. The most common crop is mountain rice but other crops are raised also. It is possible to distinguish a transition between the pure migrating type, where a section once used may for a long time not be used again, and the tribe wander along, to a new field of action and a more permanent type where the same area constantly provides crop fields and the same section will be used again after a few years of fallow. This latter type has the advantage of permanent settlements and is most typical for Malaysia. Around the homes fruits and vegetables are raised; coconuts are of importance and small plots of sugar cane, tobacco, peanuts, corn and cassava give greater variety to agricultural production.

This advanced type of milpa agriculture has penetrated to the most isolated spots of the islands. The Dajak of Borneo, the Papua of New Guinea, and the Moro of Mindanao stand for a great part on this agricultural level. The Dutch expedition of 1920 to the New Guinea mountains from the Mambuamo River found in the "Swart" Valley a group of people, which were in their mountain valley almost completely isolated but who had regular fields of sweet potatoes and around the houses little plots of bananas, peanuts, tobacco, and colocasia, as well as the betel palm (areca catechu). The ladang is certainly the most typical land utilization of Malaysia even though the majority of the population does not depend on it.

Dry Cropland. Permanent cropland, is the next, and in many regions where irrigation is impossible, the last step in land utilization. Crop raising becomes more intensive. Plows are used and work animals—the buffalo and the cow. Crop rotation is sometimes followed; manure may be used. Still a part of the land is fallow, but no longer for a protracted time, as on the ladang. Rice is still the chief dry crop, but corn (maize) also is grown, for example in east Java and southwest Celebes.

The extent of this dry cropland is difficult to determine, because in many of the islands it falls under the heading "ladang," while on Java it is often confused with the area used for secondary crops on the sawahs after the irrigated rice crop is harvested. The island of Madura (northeast of Java) can serve as an example of the development of dry cropland because it is too flat to offer good possibilities for irrigation. Sawahs account only for one-quarter of the cultivated area, which occupies 80 to 90 per cent of the island, leaving the remaining three-quarters for dry cropland. The climate with a long dry season and a rainfall of 60 inches favors corn as a major crop.

Irrigated Cropland. Irrigated rice fields, the so-called sawahs, are the pride of Malaysian agriculture. Java is in this respect the most prominent—here almost eight million acres are irrigated. The islands of Bali and Lombok show the same agricultural conditions as their western neighbor. Sumatra has only a few sections of the intensive type of land utilization, namely parts of the west coast, the Padang Highlands, the coasts of Atjeh in the north and the Lampangs in the south. Sawahs form a zone along the west coast of the Malay Peninsula and along some of the eastern river basins. In Borneo irrigated rice fields are limited to a number of coastal plains; the Kapuas Valley in the west; the regions east of Bandjeimasin in the south and parts of the coasts of Sarawak; Brunei and Borneo; farther on in southwest Celebes, some section of the Central Upland and the northeast and finally the islands of the Philippines

with Luzon as outstanding. The terraced rice fields of the Ifugaos are cited often as classical examples of this type of land utilization. Sawahs are rare in the Lesser Sunda Islands and practically absent on the Moluccas and New Guinea.

Lowland sawahs are the rule; the terraced mountain slopes are spectacular

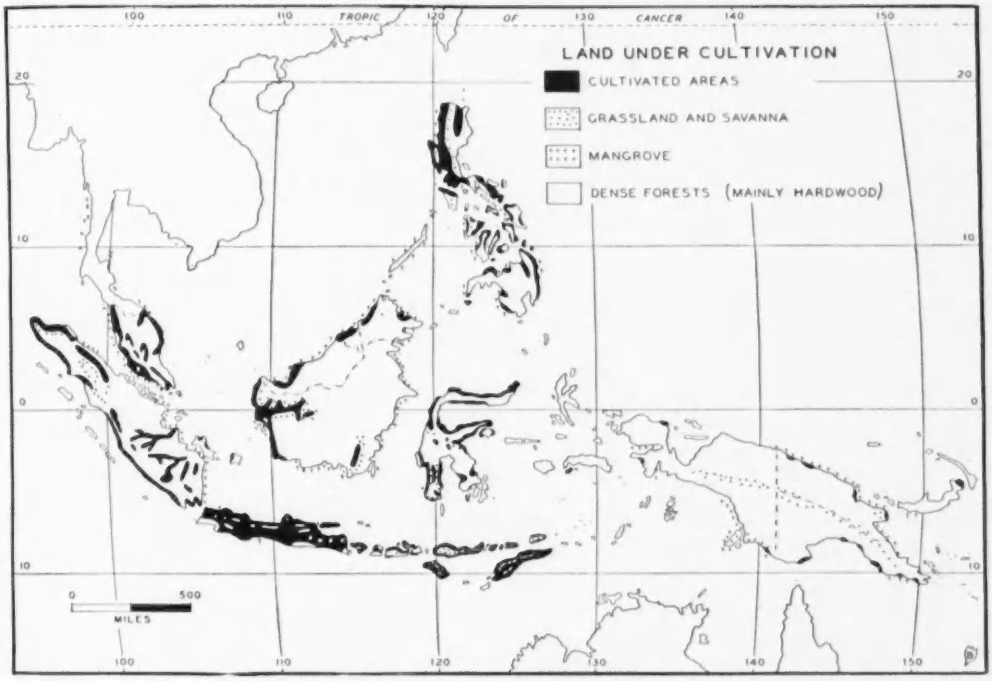


FIGURE 7.—Except for relatively limited areas of favorable relief, drainage, soil, and climate, where land may be successfully cultivated, the islands of Malaysia are covered with dense forests which in themselves constitute a serious handicap to agriculture. (Partly according to Van Steenis.)

but are relatively of minor importance. Only in a few favorite spots is the rice crop continuous; this is, for instance, done in some mountain basins of west Java under exceptional conditions of rainfall and soil fertility. While in many regions the sawahs lie fallow during the dry season, the general tendency is towards the raising of secondary crops, which complement the rice in the diet.

In Java the secondary crops rank in order of their importance: corn, cassava, sweet potatoes, peanuts, soy beans, and other pulses. The combination of sawah rice and secondary crops shows the highest development of land utilization of Malaysia. In the section where it is practiced are the most prosperous villages, where garden plots and fruit trees surround the homes.

Here, also, is the major development of stock raising. Buffaloes dominate in sections with heavy rain, cows in the drier part. Both animals are used almost entirely for work purposes. Horses are used for riding, and, with the cattle, as draft animals. It is only in the islands near Australia with the long dry season (Sumbawa, Sumba, Timor) that stock raising—especially of horses—is prominent in spite of the absence of sawahs; a response to the savanna landscape. Fish ponds store the fish which replace meat in the diet

except for the always present chicken; in some sections the sawahs are used for that purpose after the rice harvest. The number of fruits is astonishing, but the quality is not trustworthy. In the regional description it will be possible to revert to this advanced type of rural economy.

Native Commercial Crops: General

Native commercial crops have developed under the demand of a good market. The spices, which once brought the European explorers to these islands, were in ancient times commercial crops, raised for other purposes than the local market. Later on under governmental pressure other commercial crops such as sugar and coffee came into existence. The introduction of plantation crops also resulted in many cases in the growth of a similar native production, sometimes connected with the plantations, but often entirely separate. In the Philippines the commercial crops have gone their way of production beyond the general scope of native agriculture and approach the plantation type; they will be treated later in the more detailed description.

Major Native Commercial Crops

Coconut and its commercial product *copra* rank first in economic importance. Except in the southern part, coconut palms are nowhere absent along the coastal plains and in the lower mountain regions. Copra in that way has become an export crop of high value from the Netherlands East Indies as well as from the Philippine Islands. Only part of the production is used commercially; most of it is used in the native household where the coconut oil is the source of fat for the diet. European estates have also entered this field and an acre-

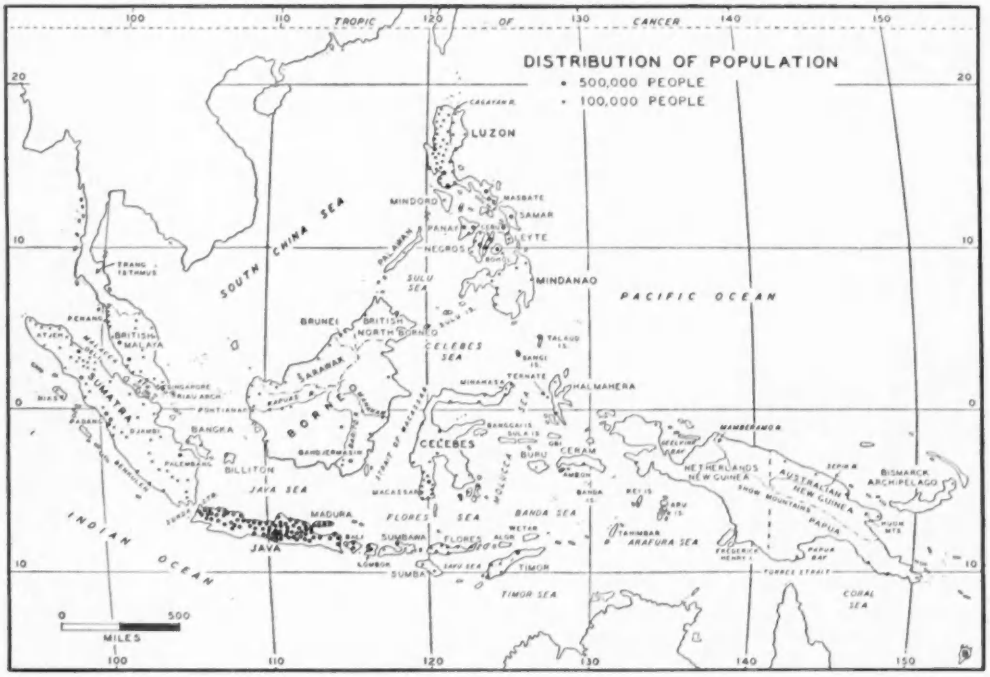


FIGURE 8.—The areas of concentration of population correspond very closely to the areas of cultivated land, because conditions favorable to the one are favorable for the other.

age of 75,000 in the Netherlands East Indies alone competes with the native output.

Fibers produced by native agriculture comprise *cotton*—which is only of minor importance—and *kapok*, which, especially in Java, has become a factor on the world market as an export. Kapok is obtained from the fruits of the Ceiba pentandra; the flossy woolly substance is an excellent stuffing material and is for that purpose widely used in North America and Europe.

Essential oils other than those mentioned under forest products are the citronella oil of west Java, with its high geraniol content, and the lemon grass oil.

Spice. The ancient production of nutmeg and cloves persists in the Moluccas as well as on some of the other islands. Well-known in the Moluccas for their spices, are Banda, Ambon and Ternate. Of nutmeg and mace the islands still produce the major part of the world supply. European spice gardens make the production only partly native. Commercially of greater significance is the production of *pepper*, black as well as white. Sumatra is here the major producer, with the south (Lampang) and north (Atjeh) as chief centers. Here also European enterprises have entered the field. *Cinnamon* (cassia) is a product of the Padang Highlands. In Sumatra also is the chief production of *gambir*, a tannin used for chewing purposes as accessory to the popular sirih chew; a few estates have also taken up its production. The native production of rubber (Hevea), tea, and coffee, as well as tobacco, will be taken up in the later discussion of the corresponding estate crop.

Plantation Agriculture

Plantation, or estate type of land utilization, has been described before as the coöperation between European or American (and sometimes Japanese and Chinese) capital, scientific knowledge and energy and native labor in order to raise certain crops for the world market. Indo-China with the Annam Plateau, India with Assam and the Nilgire Hills, and especially Ceylon, have already provided examples of this type of agricultural economy but here on Java and Sumatra (and for rubber, also, the

ESTATE AGRICULTURE OF THE NETHERLANDS EAST INDIES (1931)

	Java	*Other Provinces*	*Total*	*Share of world production or export (including also native production)*
Planted area (thousand acres)	1,750	1,400	3,150	
Cane sugar (thousand kilograms)	2,772,443	....	2,772,443	14 per cent (a)
Hevea (thousand kilograms)	79,884	94,915	165,799	33 " (b)
Gutta percha (thousand kilograms)	98	....	98	almost all
Coffee (thousand kilograms)	38,112	10,633	48,745	5 per cent
Tea (thousand kilograms)	67,609	13,700	81,309	20 "
Tobacco (thousand kilograms)	45,827	18,149	63,976	3 " (c)
Cinchona (thousand kilograms)	9,056	1,569	10,625	+90 "
Cocoa (thousand kilograms)	1,300	....	1,300	insignificant
Copra (thousand kilograms)	1,902	21,137	23,039	33 per cent (d)
Coca (thousand kilograms)	244	8	252	
Palm oil (thousand kilograms)	125	64,332	64,457	17 per cent
Nutmeg (in thousand pieces)	184	378	562	main source in world production
Kapok (in thousand cobs)	25,634	....	25,634	82 per cent
Fibers (e) (thousand kilograms)	18,287	970	19,257	
Cassava (thousand kilograms)	40,756	....	40,756	
Gambir (thousand kilograms)	....	3,226	3,226	(f)
Pepper (thousand kilograms)	65	65	130	80 per cent (f)

Remarks: (a) Philippine Islands—6 per cent.
(b) Malaya—54 per cent; British Borneo—2 per cent.
(c) Philippines—2 per cent of world production.
(d) Philippines—32 per cent; British Malaya—8 per cent; British Borneo—1 per cent; New Guinea—5 per cent.
(e) Philippines—world production of Manila hemp.
(f) The native production is here far more important than the estate crop.

Malay Peninsula) it finds its greatest development. Foreign energy, supported by foreign capital, with cheap labor, has transformed wide areas of tropical forests and jungle into regularly planted gardens of valuable export products, which under ordinary conditions of the world market can be sold advantageously. In recent years low prices and relative overproduction or underconsumption have played such havoc with estate agriculture that many estates have been sold while others barely manage to keep going. The accompanying table gives production figures of estate agriculture of Sumatra and Java for the year 1931 (a rather average year) with some reference to production of Malaya and the Philippines.

Very impressive is the high ranking of Java in estate products despite its dense population and almost complete self-sufficiency. It offers the best proof that estate agriculture under strict control does not limit food production but forms a valuable supplement that helps to raise the economic and social level of native life.

The estate crops will be treated with the regions in which they reach the peak of their production. Thus rubber will be discussed with the Malay Peninsula; tobacco, oil palms, and agave fiber with northeast Sumatra; tea, quinine, and gutta-percha with west Java; sugar, coffee, and cacao with central and east Java. Also the chief crops of the Philippines (sugar, tobacco, and manila hemp), which are a transition between native and estate agriculture, will be treated with the description of that region. The production of coconuts, kapok, gamba pepper, and other spices, which is only for a small part due to estates, has already been mentioned under native commercial crops. Outside Java, Sumatra, the Malay Peninsula, and the Philippines, only a few regions need citation. Rubber estates are found along the coasts of Sarawak, Brunei, and British North Borneo, with a total production of 2 per cent of that of the world. British Borneo had, also, a number of tobacco estates, which seem to have been closed recently.

Portuguese Timor has a variety of estate crops mainly under government control; of these, only coffee has retained its significance, while the former important cacao production has practically disappeared. Finally, Papua and the adjacent New Guinea mandate have an estate acreage of 140,000 acres in coconut.

THE PACIFIC COAST HALIBUT FISHERY[1]

John Q. Adams

THE Pacific Coast halibut fishery is of interest because of its commercial importance, great distance from market, wide extent, rapid rise, and threatened decline. According to the value of its products this fishery ranks second among the fisheries of the Pacific Coast of North America (Table I) and ninth among the regional fisheries of the United States (Table II). During the post-war period of relative prosperity more than one-half of the world's total catch of halibut was produced in this area (Table III).

Main Aspects and Problems

The Pacific halibut fishery is unique among the world's major fisheries which produce fresh fish in that the chief centers of production are from four to five thousand miles from the main centers of consumption. An even more interesting aspect of this fishery is that in slightly less than fifty years it has spread along the North Pacific Coast for a distance of more than two thousand miles. In spite of the enormous extent of the producing area it has been necessary to adopt strong conservation measures in order to save the stock of halibut. However, if the supply of fish is so conserved, the future of the fishery still remains somewhat uncertain as a result of increasing competition of Japanese and North Atlantic fisheries.

Conditions Favoring the Industry

The existence of such a productive fishery extending over so large an area and located so far from its market is made possible by several factors, namely: an abundance of halibut along the North Pacific Coast, a strong demand for fresh halibut in the large cities of eastern North America which could not be supplied by the Atlantic fishery, the

TABLE I

Leading Pacific Coast Fisheries of the United States and Canada, 1932

Ranked by Value of the Catch
(Gold dollars of 1932)

1. Salmon	$15,993,000
2. Halibut	3,719,793
3. Tuna	2,704,000
4. Herring	1,633,951*
5. Pilchard	1,508,187
6. Flounders	564,000
7. Cod	516,752
8. Oysters	416,000*
9. Crabs	387,000*
10. Barracuda	363,000

* Statistics for Canada partially estimated.

Sources—U. S. Tariff Commission Report No. 69, Second Series, 1933, and Report, Commissioner of Fisheries, British Columbia, for 1932.

TABLE II

Chief Regional Fisheries of the United States by Value of Products, 1932 *

Leading Producing Areas Only Are Listed

1. Salmon (Pacific)	$12,406,000
2. Oysters (Atlantic-Gulf)	10,254,000
3. Haddock (Atlantic)	5,430,000
4. Lobsters (Atlantic)	3,043,000
5. Shrimp (Atlantic)	2,784,000
6. Tuna (Pacific)	2,704,000
7. Cod (Atlantic)	2,579,000
8. Clams (Atlantic-Gulf)	2,558,000
9. Halibut (Pacific)	2,504,000
10. Flounders (Atlantic-Gulf)	1,994,000
11. Mackerel (Atlantic)	1,865,000
12. Whitefish (Lakes)	1,646,000
13. Shad (Atlantic-Gulf)	1,394,000
14. Pilchard (Pacific)	1,185,000

* Source—U. S. Fisheries, 1932, Department of Commerce, 1933.

Values are in gold dollars of 1932.

TABLE III

Halibut Fisheries of the World, 1928–1929 *

Ranked by Volume of Product

	Pounds	*Percentage*
1. Pacific Coasts of United States and Canada (1929)	57,692,595	57.1
2. European fisheries (1928)	36,307,000	36.0
3. Atlantic Coasts of United States and Canada (1928)	6,095,779	6.0
4. Japan (Hokkaido, 1928)	871,488	.9
Total	100,966,862	100.0

* Source—International Fisheries Commission Report No. 7.

[1] The more important sources of data exclusive of the author's observations in the field are: the staff and publications of the International Fisheries Commission, the *Pacific Fisherman Magazine*, Reports of British Columbia Fisheries Commission, Bulletins of the U. S. Bureau of Fisheries, Reports of the U. S. Tariff Commission, and the Prince Rupert, B. C., *Daily News*.

excellent keeping qualities of the fresh halibut, and an efficient system of catching, preserving, storing, and transporting the fish.

Halibut are present in large numbers along the North Pacific Coast as a result of the presence there of cool waters (4°–7° C.), many areas of sand or gravel bottom, extensive shallow zones (under 150 fathoms), and an abundance of food, chiefly other fish such as cods, sand launces, and herring. Also, the large size of the mature fish (Hippoglossus hippoglossus, Figure 1) protects it from the attack of most other local marine fauna the chief exceptions being sharks, seals, and sea lions.

Fresh Pacific Coast halibut is much in demand as a result of its excellent flavor, its whiteness, and the familiarity of the eastern consumers with the species which is the same as the North Atlantic halibut. Demand is centered in the urban zone of Eastern North America because of the greater number of consumers in this densely populated area and the better facilities there for storing and distributing the fish. Since 1890 this demand has been greater than could be supplied from the nearby banks in the North Atlantic. As a result of these conditions fresh halibut brings a relatively high price on the eastern markets. In turn the high price level has made it possible to operate a complicated and expensive system of preserving and transporting this highly perishable commodity.

This system, which takes advantage of the excellent keeping qualities of halibut, is based on refrigeration of the fish from the time it is caught until it reaches the ultimate consumer, and rapid and reliable means of transportation. Such facilities are provided by packing the cleaned fish in crushed ice on the fishing boats which move rapidly under their own power to the landing ports; there the fish are either held temporarily in large, modern cold storage plants or are sent at once to the eastern markets in express refrigerator cars. The small part of the catch landed at ports which have no rail connections is sent to the rail head ports, Prince Rupert and Seattle (Figure 2), in steamers equipped with refrigeration. About twenty-five per cent of the catch is frozen and held in the storages to be marketed during the mid-winter closed season for halibut fishing.

THE PRODUCING AREA

Halibut are caught all along the North Pacific Coast from Cape Blanco, Oregon, to Dutch Harbor in the Aleutians, but all parts of this area are not equally productive. Almost ninety per cent of the catch is taken on the banks which lie in two zones. The first of these extends from Cape Scott at the northern end of Vancouver Island to Cape Spencer, Alaska, and the second lies off the Alaskan Coast between Middleton Island and the Shumagin Islands (Table IV and Figure 2). Almost all the halibut catch not taken within the two great producing areas is caught on the banks which lie between them, i.e., between Cape Spencer and Middleton Island.

The high productivity of the two great zones is due primarily to the greater abundance of halibut, which, in turn, is chiefly a result of favorable local combinations of large shallow areas and abundant food supply. An important secondary factor which helps to maintain the high, though declining, volume of the catch in the southern zone, Cape Scott to Cape Spencer, is the increasing intensity of the fishing in that zone. Declining abundance of fish due to overfishing on these grounds has forced the adoption of more efficient methods in order to maintain the catch at a profitable level.

Longer trips, new methods of fishing, and mechanical improvements in the

TABLE IV

REGIONAL DISTRIBUTION OF THE PACIFIC COAST HALIBUT CATCH OF 1929*

Where Taken	*Amount In Million Lbs. (Round numbers)*	*Per Cent (Even figures)*
Cape Scott to Cape Spencer	25.0	44+
Middleton Island to Shumagin Islands	24.0	42+
Cape Spencer to Middleton Island	5.5	10−
South of Cape Scott and west of Shumagin Islands	2.0	4−
Total	56.5	100

* Source—Report No. 7, International Fisheries Commission.

boats and fishing gear have all played a part in maintaining the total yield in the face of a declining stock of halibut. Probably the greatest single improvement has been the development of a method of handling the fishing lines direct from the vessel instead of from dories (Figure 3). These "long lines set at the bottom with short attached lines carrying the hooks at regular intervals" have been used from the inception of the fishery because halibut often are found on bottom that is too rough for the use of drag lines or nets. Advantages of direct "long-line" fishing over the dory method are: a reduction in the number of men per boat, greater speed in setting and hauling in the gear, and ability to fish in rougher weather and throughout the night, this latter advantage being particularly helpful during the long winter nights in the high latitudes. Other improvements such as electric lights, cork insulated fish holds, and the adoption of the more economical Diesel engine have been of aid in combating the declining yield from the southern banks.

In spite of the improvements in fishing methods and gear the total yield from the southern grounds has declined slowly but surely. Consequently, during the years 1913–1928 new sources of supply were sought and found in the great banks west of Cape Spencer. These distant banks could be exploited only after development of new facilities, such as the completion of the Grand Trunk Pacific Railway to Prince Rupert in 1913; the building of cold storage plants at Prince Rupert, Ketchikan, Wrangell, and Juneau (1910–1913); and the use by the fishermen of the more economical and safer Diesel engine (1923–1928).

Exploitation of the new western banks has not relieved the drain on the southern grounds. A new, larger, and more costly type of boat (Figure 4) is necessary in order to reach these distant banks, hundreds of miles beyond the nearest railhead, and many fishermen are not able to invest in such expensive craft. Also, both the United States and Canada prevent foreign boats fishing within three miles of shore. This limitation is felt particularly by the smaller boats which are of necessity limited to fishing in the more quiet waters among the islands south of Cape Spencer (Figure 3). These small boats of the Canadian and American fleets are restricted to their respective territorial waters with little possibility of shifting

FIGURE 1.—Large medium halibut, 40–60 pounds. The halibut is a bottom dwelling flatfish. It swims on its side with the right side of the fish always upward. Both eyes are on this side in the mature fish. The large fish in the center foreground of the picture is lying upside down with the blind lower, or left, side above. (Courtesy of the *Pacific Fisherman.*)

from one area to another as the stocks of fish vary from year to year. Another factor that promotes overfishing in the south is the American tariff of two cents per pound on halibut. This charge so reduces the possible profit margin of the Canadian fishermen that most of them fish exclusively on the nearby southern banks which may be reached at less expense.

PROBLEMS OF CONSERVATION AND PRICE STABILIZATION

Conservation of the stocks of halibut on the banks has been advocated for twenty years and has been practiced with a varying degree of success for ten years. The movement to save the fishery started in 1914 after the opening of the new banks between Cape Spencer and Middleton Island had flooded the market with late spawning fish taken during November. The handicap resulting from the increased effort necessary to obtain a given amount of fish on the southern grounds long had been realized, but as long as prices remained high no effort was made to counteract this tendency. Even less attention was paid to the ultimate danger of destroying the industry through overfishing. However, when the late fall catches from the new grounds caused prices to break a demand was made from within the industry that fishing be limited in some way so as to hold prices at a profitable level, and preserve the stock of fish on the grounds. The path toward these two objectives has been a difficult one and the movement along it has been slow but up to the present time (1935) at least partial success has been attained.

The original conservation movement, in 1914, advocated a winter closed season which would have been particularly effective in reducing the catch from the spawning banks just west of Cape Spencer. The fishermen were unable to secure the desired results by voluntary agreement and legislation was requested. This was delayed by the World War and the necessity of getting international accord. Such accord was reached in 1924 when the United States and Great Britain (actually, Canada) agreed on certain control measures which were embodied in a treaty.

Essential provisions of the halibut treaty of 1924 were: (1) the declaration of a closed season from November 16 to February 15, and (2) the creation of an International Fisheries Commission of four members for the purpose of making ". . . a thorough investigation into the life history of the Pacific halibut . . ." and on this basis submitting ". . . recommendations as to the regulation of the halibut fishery . . . which may seem to be desirable for its preservation and development."

Reports of the International Fisheries Commission published in 1928–29–30 showed the perilous position of the fishery. The abundance of fish as shown by the amount caught on a standard unit of gear, i.e., per 1,800 feet of line, had declined eighty-four per cent on the southern banks in the years 1906–1926, and sixty-two per cent on the western banks in the period 1923–1926. On the southern banks very few fish of spawning age were left, the existing stocks consisting chiefly of immature fish spawned five to eight years before. These depleted stocks were not being renewed from the more abundant stocks on the western banks because there was no southward movement of either fish or larvae. The stocks of mature fish on either side of Cape Spencer were independent and the currents in the Gulf of Alaska carried the locally spawned larvae westward instead of southward. The closed season was found to be beneficial but too short.

As a result of recommendations based

on the findings of the Commission a second treaty for the control of the Pacific halibut fisheries was signed in 1931. The chief provisions of this new convention are: (1) A closed season from November 1 to February 15, two weeks longer than under the old treaty; (2) retention of the International Fisheries Commission which in addition to its former duties to investigate and report is given power to; (a) shorten or suspend the closed season subject to the approval of the executive branches of the two governments; (b) divide the convention waters into areas; (c) limit the catch or halibut within each area; (d) determine the amount and type of fishing gear to be used; (e) prohibit fishing in areas populated by immature halibut; (f) make regulations for the collection of statistics which will aid in the work of conserving the halibut.

In accordance with the powers given them under the new treaty the International Fisheries Commission issued regulations which began with the season of 1932 and have continued with slight modification until the present. For example, the regulations for the fishing season of 1934 had the following basic provisions. The coastal zone was divided into four areas: Area One, south of Cape Shoalwater, Washington (Figure 2); Area Two, from Cape Shoalwater to Cape Spencer, Alaska; Area Three, from Cape Spencer to Unimak Pass, Aleutian Islands; and Area Four, west of Unimak Pass and in the Bering Sea. The total catch of halibut for areas Two and Three was limited to 21,700,000 pounds and 24,300,000 pounds respectively. There was no limit on the catch from areas One and Four. Fishing for halibut was prohibited on two small spawning grounds south of Cape Spencer. The open season began March 1, 1934 (it was January 19 in 1932 and February 1 in 1933) and was to close in each area as nearly as possible on the date on which

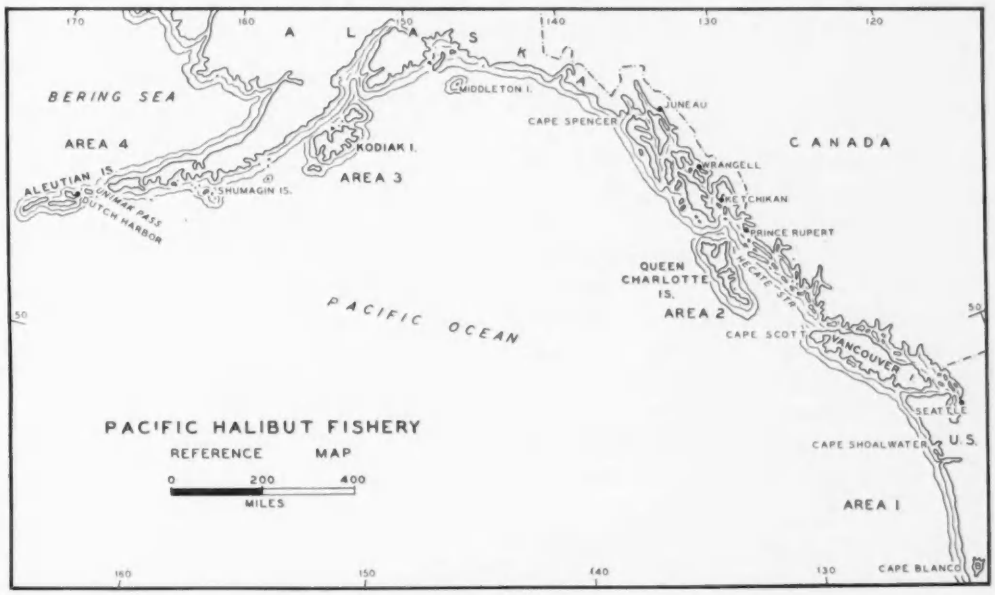


FIGURE 2.—The several areas of the Pacific halibut fisheries are indicated along the coast from Cape Blanco south of Seattle, to the Bering Sea about Nome. Each area has its own advantages and disadvantages, and all contribute to the importance of the industry.

the quota for that area was reached. As a consequence of this ruling, Area Two was closed August 19 and Area Three, October 27. These closing dates were announced several weeks in advance by the Commission. Area One was closed on the date fixed for Area Two and Area Four on the same date as Area Three. All halibut boats were licensed and required to report to the Commission the amount of each catch and the banks where taken. Fish buyers could be required to submit to the Commission records of their purchases of halibut. Finally, the old method of catching fish from dories (small boats) was prohibited in Area Two, but this prohibition was suspended temporarily (Figure 5).

Little explanation is needed for these regulations. Cape Spencer is a natural point of division both for the stocks of fish and the fleet as has already been explained. Area One is devoted to a small local fishery from relatively minute stocks, and Area Four is so far from the ports of landing that it is geographically beyond the present limits of profitable fishing. Total catches for each area are fixed near the amounts which have been taken in recent years so as to work as little hardship on the fleet as possible. The closed areas and the restriction on dories are to aid toward restocking the banks in Area Two; and the required information is to aid the Commission in checking the effect of its regulations and planning future changes.

The chief results of the new regulations have been to bring about an early closure of the fishing season and a slight increase in the stocks of fish on the banks. In 1933, Area Two reached its quota before the end of the regular open season and was closed October 22, ten days early. Area Three remained open until the end of the season, November 1. In 1933, due to increased intensity of fishing, Area Two was closed August 25 and Area Three, October 26. Increase in the stock of fish on the banks in 1933 as compared with 1932 was 9.3 per cent south of Cape Spencer and 9.7 per cent west of that point. However, the stocks are not expected to show any great increase for several years because the theoretically increased amount of spawn now being produced by the larger stocks of mature fish, will not reach marketable size until 1938–40. This ultimate increase may be delayed even longer on the southern banks because a special investigation of the Commission in 1933 revealed few spawners and "but little spawn" in Area Two.

One expected result of the new conservation measures was not forthcoming, i.e., an increase in the price of halibut. Although production was restricted well below the levels of previous years the depressed market of 1932 could not absorb the catch of 46,000,000 pounds of halibut at prices which would yield a satisfactory return to the fishermen. As a result, in 1932 numbers of halibut boats were diverted to other uses or tied up and many of those that did operate showed a net loss for the season.

When the 1933 season showed no increase in demand the Seattle fishermen agreed to a plan to restrict production. This plan, which reduced the piling up of catches on certain days as well as limited the total catch per man and per boat, would have cut the 1933 catch for the entire coast to approximately 35,000,000 pounds if the Canadian and Alaskan fishermen had also adopted the plan. Their failure to do so let the catch go to the 46,000,000 pound limit set by the Commission, depressed prices on all but the Seattle market, and caused Area Two where most of the Canadian and Alaskan boats operate, to be closed sixty days ahead of Area Three. The higher prices and longer open season, in Area Three, enjoyed by the Seattle fishermen

so impressed the Canadian and Alaskan groups that they readily assented to a plan for 1934 similar to the one used at Seattle in 1933. This plan varied slightly in its application to the groups of fishermen at the different ports, but the chief objective was to hold the price of halibut at a satisfactory level by limiting the annual catch and by pre-

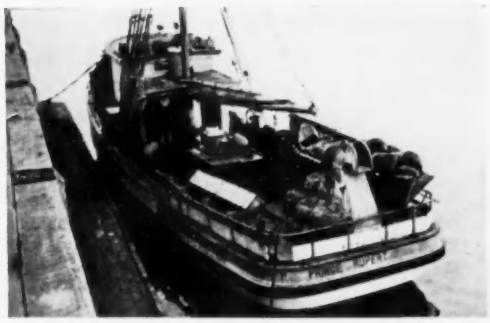


FIGURE 3.—Smaller type of boat used on the southern grounds. Note the inflated rubber bladders and poles with cork floats (at the left) used to mark the location of fish lines when set, and the elevated chute at the stern over which a line with baited hooks can be played out without danger to the men. Lines are drawn in over the side by a power winch located near the base of the mast. Compare with Figures 4 and 5.

venting temporary glutting of the market at any landing port. For example, at Prince Rupert, B. C., each boat fishing in Area Two was limited to a catch of 3,300 pounds of dressed fish per man per trip and each boat was required to remain in port seven days between trips. A control board elected by the fishermen had a right to alter the length of these periods of idleness so as to create a more even distribution of sailings and arrivals and thereby prevent the landing of an excessive amount of fish in one day. Boats that fished in Area Three and sold their catch at Seattle might take 4,000 pounds per man in order to compensate for the longer trip and the lower price obtained for the fish.

Several important results were obtained by the adoption of these control measures. Most important to the trade was the rise in the price of the different grades of halibut. Throughout the 1934 season prices remained above the 1933 level and they were remarkably steady due to control over the rate as well as volume of production. Sums received for catches were large enough to assure a profit on each trip to all boats that did not encounter some major disaster.

Another result was the great increase in the amount of fish landed at Seattle. The small catches allowed per trip enabled the large Seattle boats to reach their limit quickly on the distant western grounds and return all the way home past the Alaskan and Canadian ports and land the fish in good condition. A second factor favoring Seattle was the desire of the fishermen to spend their enforced periods of idleness at home. Consequently, whenever possible the Seattle boats return to the home port with their fish even though they are much nearer a northern port when they complete their catch. A more lasting and beneficial result of these restrictions is the lessening of the drain on the stocks of halibut on the banks. This favorable condition is modified somewhat by the tendency of the fishermen to discard the smallest fish, i.e., those weighing less than ten pounds, because their weight counts in the total allowed per trip, but they bring a lower price per pound than the larger fish. The Commission has threatened to lower the catch limits further unless this practice is stopped.

UNSOLVED PROBLEMS

Apparent solution of the problems of conservation and overproduction serves to throw into relief two less pressing but nevertheless serious problems which must be solved if the industry is to maintain its present importance. These two points to be solved are the invasion of the United States market by cheap

frozen halibut from Japan and the displacement of fresh halibut by less expensive fresh fillet of haddock from the Atlantic fisheries of North America.

Japan has been developing a halibut fishery off the coast of Siberia since 1925 and shipments from that source first reached large proportions in 1929 when 416,000 pounds of frozen fish were imported. Since that year importations have fluctuated, amounting to only 1,090 pounds in 1931, increasing to 78,289 pounds in 1932, rising almost to the 1929 level in the fall of 1933. At this time the Japanese product with tariff paid was underselling the American and Canadian fish by two cents per pound which was fifteen to twenty per cent of the selling price of the various grades. With prices at a higher level in 1934 much heavier shipments of Japanese fish were expected. Because most of the increase in the price of halibut in 1933 and 1934 was due to restrictive measures entailing sacrifices on the part of American and Canadian fishermen and dealers plus compliance of the larger American organization with National Recovery Administration requirements, there is unusually keen resentment at this invasion of the chief market by halibut from an area of very low paid labor. This feeling is only increased at the prospect of probable shipments of fresh halibut from Japan as soon as some improvement is made in the technique of packing and the speed of delivering the fish.

As a result of these actual and impending conditions there is a demand from some of the American fishermen that a higher import tariff be levied on both fresh and frozen halibut. However, if the United States should impose higher duties in order to reduce competition of Japanese halibut the higher cost Canadian halibut would be excluded to an even greater degree. Apparently the use of the tariff to eliminate Canadian as well as Japanese competition would also seem desirable from the viewpoint of the American fishermen. However, such elimination has certain disadvantages, namely: fear of retaliation against American fishermen along both the Pacific and Atlantic coasts of Canada, and the revolt of the American consumers against the markedly higher prices of halibut which probably would prevail in the closed market produced by the higher tariff.

The expected retaliation on the part of Canada could take the form of refusing to American fishermen their present rights to buy bait, fuel, and supplies, to take on crews, and to land fish and ship them through Canadian territory. Such restrictions would seriously interfere with, if not terminate, the operations of a considerable part of both our Pacific and Atlantic fishing fleets.

FIGURE 4.—Larger type of boat, used for long trips to the western grounds. These boats are not only larger than other types but are faster and are always equipped with the powerful but economical diesel engine. (Courtesy of the International Fisheries Commission.)

The second undesired reaction to any increase of the import duty on halibut, i.e., loss of consumers due to the higher selling price of the more protected commodity, is already indicated by the widespread substitution of the cheaper fillet of haddock for halibut. The rapid rise in importance of the fillet of haddock in

the American diet has been only partially at the expense of halibut; nevertheless, the halibut trade has felt this competition enough to show " . . . a decline in the demand for halibut in certain markets, reducing the general level of halibut prices."

Halibut has been displaced by haddock, the flesh of which is similar in color and to a lesser degree in flavor, because the haddock is cheaper, it is marketed in the convenient fillet (boned steak) form, and it is better known to many consumers. Haddock is cheaper because it is available in enormous quantity in the grounds along the North Atlantic seaboard. The fact that haddock has not been favored widely as a food until recent years has conserved the large original stock. Nearness of the haddock producing grounds to the chief market areas has made possible lower transportation costs than in the case of Pacific Coast halibut. A further reduction in these costs has been made possible by shipping the fish already cut into fillets and thereby eliminating the fifty per cent, by weight, of skin, bones, and trimmings which must be discarded from fresh dressed fish such as halibut or haddock. Other advantages of marketing haddock, or any other fish in the form of fillets, are: "the entire piece purchased by the consumer is edible, there is no scaling, gutting, and cleaning to be done," the fifty to seventy per cent, by weight, of waste is all left with the producer who may treat it for by-products, the fillets are usually packed better than whole fish and suffer less damage in transit. Finally, the fillet of haddock, often referred to merely as fresh fillet of fish or ocean fish, is better known to the average housewife in the interior states as a result of the extensive advertising and other aggressive sales methods used by the distributors of haddock.

FIGURE 5.—Old method, fishing from a dory. The line is drawn in by the man at the right using a hand winch locally called a gurdy. Fish are thrown in the net by means of which they are later hoisted onto the fishing vessel. (Courtesy of the International Fisheries Commission.)

It is clear that the halibut trade must act and act quickly in order to meet the ever increasing competition of the fresh haddock. Cost to the consumer must be reduced and quality maintained or increased. These two objectives may be approached if not attained (1) by technical improvements in gear and boats such as the recently developed lights which permit night fishing, (2) by cutting transportation costs through the use of much lighter refrigerator cars such as the one recently designed by the technical staff of the Fisheries Commission, (3) by preventing deterioration of the

fish in transit and storage through the adoption of recently developed methods of disinfecting the fishing boats, chilling or freezing the fish, and protecting them from dehydration, and (4) above all, by the filleting of the halibut at the Pacific ports and utilizing the by-products. One of the fish products formerly discarded, the halibut liver, has recently been found to be valuable as a source of oil high in vitamins A and D. As a result of this development the halibut fishermen received an extra income of almost $150,000 from this source in 1933. If competition of the haddock becomes keener this sum and savings from other sources can be deducted from the wholesale price of halibut and the present small profits of the fishermen and dealers can still be maintained. According to present indications in the future, Pacific Coast halibut will reach the ultimate consumer as a clean, fresh, moist fillet, wrapped in cellophane, and lower in cost than ever before.

SUMMARY AND CONCLUSIONS

The Pacific Coast halibut fishery attained a position of importance in spite of its great distance from its chief market, the northeastern urban zone, because there was little competition for this large and growing market due to the decline of the older north Atlantic halibut fishery; and the distant location of the Pacific fishery was made less of a handicap, due to efficient transcontinental railway service and the excellent keeping qualities of the halibut when stored and shipped under artificial refrigeration.

The fishery is scattered irregularly along two thousand miles of the North Pacific Coast as a result of the original irregular and widespread distribution of the halibut, the great demand which led to overfishing and depletion of stocks on the more easily accessible banks, and technical improvements in the methods and equipment of the fishery which permitted exploitation of the more distant grounds.

Future development of the fishery is uncertain as a result of declining stocks of halibut on the banks due to overfishing, and invasion of important markets by Japanese halibut and North Atlantic haddock. Decline in the stocks of fish on the banks has apparently been halted temporarily by restrictions placed on the catch by a joint commission of the United States and Canadian governments and the further curtailment of production made voluntarily by the fishermen in an attempt to elevate the price level. Permanent success of these restrictive measures is not yet certain. The fishermen undoubtedly will lift their own restrictions as soon as halibut prices advance to a point near pre-depression levels, and the government regulations have not been in force long enough to show whether they can be effective over a long period of time. If all conservation measures are abandoned or prove to be ineffective, undoubtedly the stocks of fish on the banks soon will be so depleted that within a few years the industry will disappear from the older southern banks and probably from the western grounds as well.

Solution of the problem of cheap frozen halibut from Japan apparently is impossible at the present time due to existing treaties and desire of our government not to throw further strain on our relations with Japan. However, the quantity of Japanese halibut imported yearly is small as yet and all of it is frozen fish suitable only for closed season markets. Consequently this problem is not as pressing as that growing out of the competition of fresh haddock. The way out of this latter difficulty apparently lies in the adoption by the halibut trade of the methods of preparing,

distributing, and advertising fish already used by the distributors of haddock.

If existing markets are retained and conservation measures are continued with their present degree of success it is probable that: stocks of fish on the newer western banks will increase rapidly, stocks on the southern grounds will increase slowly, if at all; if the southern stocks do not rebuild, new methods and equipment will be developed, which will permit the expansion of the fishery farther to the west and north in the Aleutian Islands-Bering Sea zone, and the industry as a whole will continue to hold its place as one of the outstanding fisheries of the United States and the leading halibut fishery of the world.

The fishery has experienced most of the usual phases of an extractive industry based on animal exploitation, namely: discovery, rapid expansion, over-exploitation, and decline. However, the usual last phase, relative extinction, such as has been experienced by the California salmon fishery and the Newfoundland seal fishery, may be avoided by the Pacific Coast halibut industry if present conservation measures are continued with alterations to meet changing conditions. The mere adoption of conservation regulations by a great international fishery is almost unique, but the enforcement of such measures so as to save and perpetuate the industry is without parallel, and the efforts toward this end should be watched with interest by economic geographers throughout the world.

INDUSTRIAL DEVELOPMENT IN SÃO PAULO STATE, BRAZIL *

Preston E. James

THE industrial structure of southeastern Brazil is undergoing a process of change. It is emerging from an era of workshops and small factories of only local significance, into an era of large factory units with wider marketing areas. The symptoms and stages of this process are similar to those which have characterized the development of the highly industrialized communities of Europe and North America. The process is being retarded by the poverty of the local market and by inadequate and expensive transportation, and is being aided by important capital investments and by various artificial devices such as tariffs and port surcharges. These conditions offer a partial interpretation of the curious mixture of concentration and dissemination which characterizes the present industrial structure. In part because of lack of adequate statistical data this report will deal chiefly with São Paulo state, although similar and perhaps even greater industrial growth is now taking place in Rio de Janeiro and its hinterland.

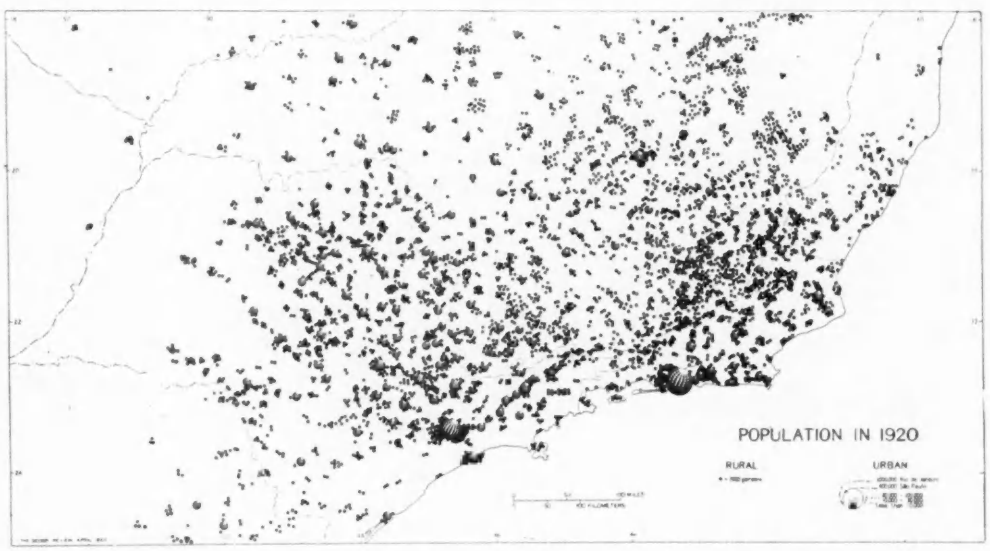


FIGURE 1.—Population of Brazil in 1920. (Courtesy of the *Geographical Review*, published by the American Geographical Society of New York.)

CHARACTER OF THE INDUSTRIES OF SÃO PAULO STATE, 1929

Percentage of Total	*Value of Production*	*Number of Workers*	*Amount of Investment*
Clothing	50.7	45.4	48.6
Chemical	10.3	5.3	8.8
Foods	7.1	8.3	4.3
Building and building materials	6.9	7.6	9.0
Paper and printing	6.5	7.1	8.6
Metal	6.2	9.6	9.4
Furnishings	4.7	7.5	3.5
Transportation	1.5	3.7	2.2
Miscellaneous	5.7	5.4	5.5

The accompanying table indicates the varied character of the industries of São

* This paper is one of a series dealing with the regional geography of southeastern Brazil, especially the hinterlands of Rio de Janeiro and São Paulo.

Paulo state. The data are compiled from the industrial census of 1929,[1] a year which probably represents at least a temporary peak of industrial growth. The clothing industries are by far the most important, their products making up half of the total value of manufactured articles in that year. In the clothing industries is invested 48% of the industrial capitalization of the state, and in these factories 45% of the workers find employment. But in addition to the clothing industries there are many others, no one of which produces more than 10% of the total value of manufactures. There are chemical industries; industries for the production of preserved foods and beverages; paper and printing establishments; producers of agricultural and industrial machinery; plants for the preparation of the materials of construction, such as lumber, cement, and plumbers' supplies; there are

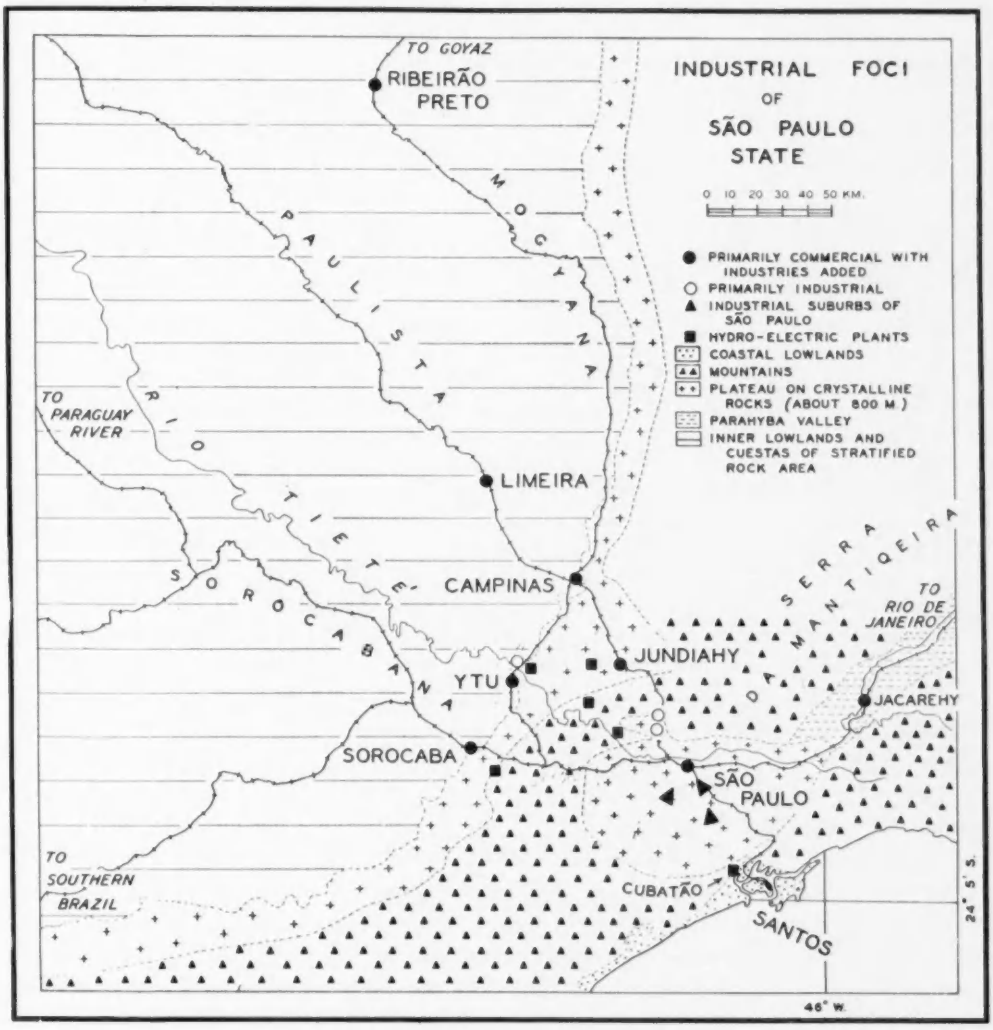


FIGURE 2.—Industrial foci of São Paulo State.

[1] Secretaria da Agric., Ind. e Commercio, Estado de São Paulo, "Estatistica Industrial do Estado de São Paulo, Anno de 1929," São Paulo, 1930.

furniture manufacturing plants; there are railroad shops, and an automobile assembly plant. There are also several meat packing establishments, the figures for which are not included in this table.

The way in which these industries fit into the general regional pattern of this part of southeastern Brazil can best be described in relation to certain other significant elements. Of basic importance are the distribution of people, the pattern of the means of circulation, and the sources of power.

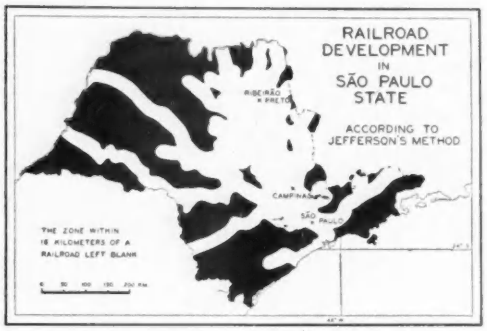


FIGURE 3.—Railroad development in São Paulo State. (After Jefferson.)

The map of the distribution of people in 1920—the last reliable census of population—does not bring out as clearly as a later map would the concentration of people in the city of São Paulo, now grown to nearly a million, and in the quarter circle of smaller cities to the north and west (Figure 1). These cities have shown a marked growth since 1920. The string of cities along the Parahyba Valley has not shown similar growth. Beyond the urban cluster around São Paulo city toward the north and west the population is moderately dense. In the coffee lands the pattern is strongly nucleated, and distinctly oriented along the main lines of travel. The urban centers, shown by the customary globe symbols, were, in 1920, almost wholly commercial in function. At the present time in this urban cluster of the southeast, and especially in São Paulo city, are found the financial center of the state, the chief supplies of industrial labor, and a relatively large market for manufactured articles.

This urban cluster is also the focus of the transportation system of the state, and had become such a focus before the era of population increase and industrial growth after 1920.[2] On the map (Figure 2) only the main lines of the several railroad systems are shown. It can be observed that on the inland side of the crystalline mountains and plateaus there are several smaller urban foci. Campinas, for instance, is the focus of both the Mogyana and the Paulista Railroad systems, serving the whole northern part of the state. Sorocaba is the focus of the Sorocabana System which gives access to the most recent pioneer coffee lands of the southwest, and which extends rail tentacles beyond the state borders to the west and south. Both Campinas and Sorocaba are connected through low passes across the crystalline mountains with the São Paulo Basin. São Paulo city is in turn connected with Rio de Janeiro, and with the sea at Santos.

But the transportation pattern brought out by these lines is still embryonic. Although the railroads in the coffee lands of the north and west form what Mark Jefferson calls an interrupted rail web (Figure 3)[3] the transportation they provide is still costly. The apparent focus on São Paulo is altogether inadequate for a city of its size: only the main line from Santos to Jundiahy is double tracked, the rest is single tracked; and the Sorocabana System is not only single tracked but also narrow gauge.

[2] A discussion of the development of this focus is contained in a previous article by the author: "Rio de Janeiro and São Paulo," *Geog. Rev.*, Vol. 23, 1933, pp. 271–291; ref. on pp. 276–277.

[3] Mark Jefferson, "The Civilizing Rails," ECON. GEOG., Vol. 4, 1928, pp. 217–231.

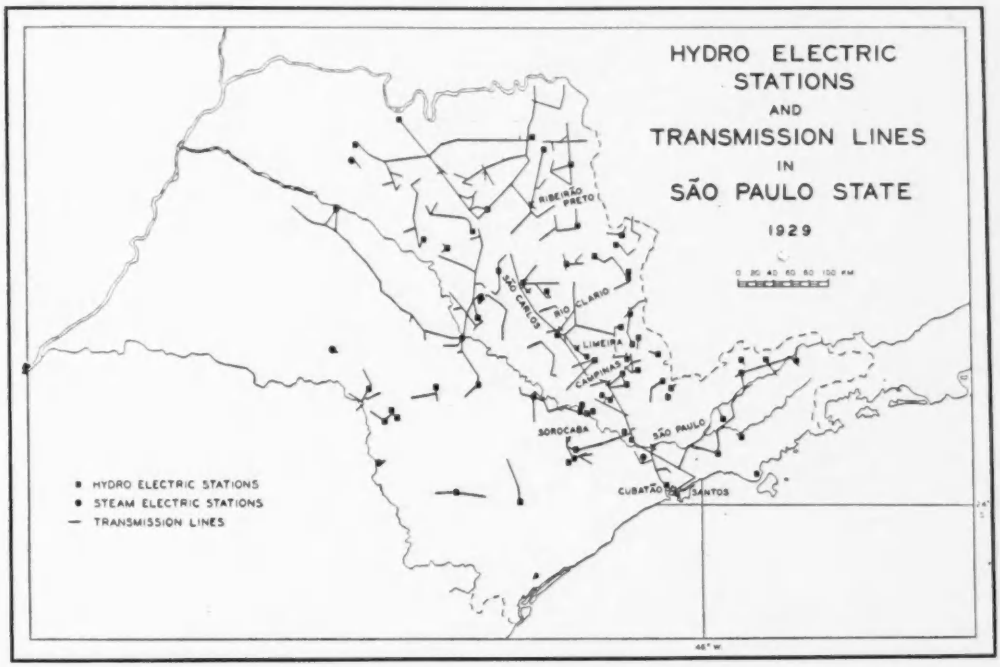


FIGURE 4.—Hydro-electric station and transmission lines in São Paulo State, 1929.

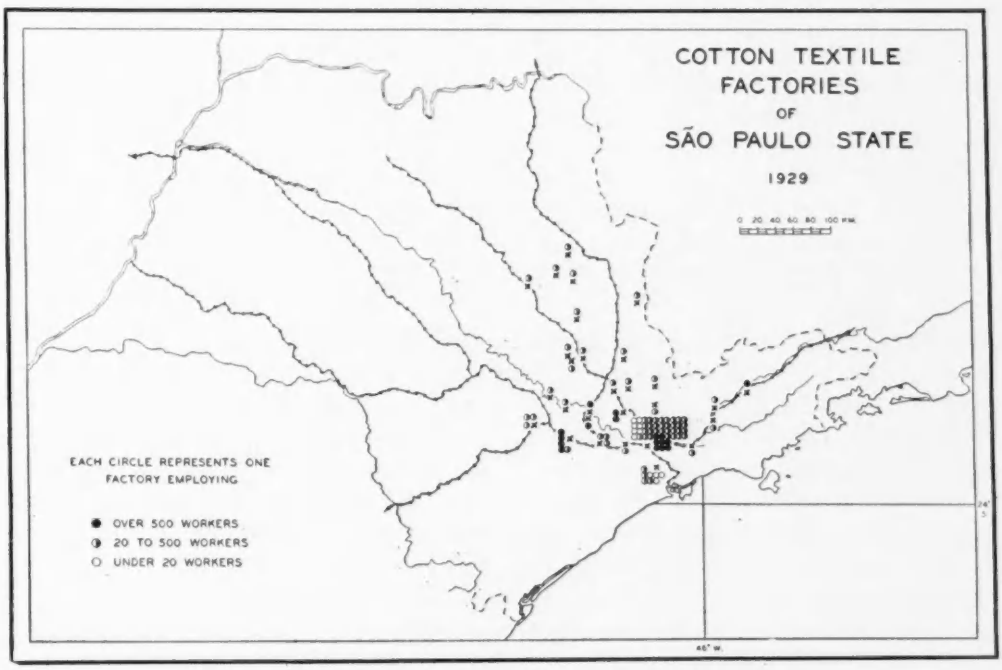


FIGURE 5.—Cotton textile factories of São Paulo State, 1929.

São Paulo, a city of nearly a million inhabitants, is connected to its hinterland by three single track lines of different gauge, and to its port over the steep escarpment of the Serra do Mar by a cable line, which, however famous it may be as a feat of railroad construction, is still an expensive means of transportation.

On the map (Figure 2) the older commercial towns are indicated by solid black circles. To each of these the industrial function has in recent years been added. The industrial suburbs of São Paulo city are shown by solid black triangles. The few purely industrial small towns are shown by circles.

Another vital element in industrial development is power. In southeastern Brazil the chief source of industrial power is hydro-electric. The lack of coal and petroleum is partially compensated by an abundance of water power.[4] The potential power sites on the Paraná River are famous; but there is more than enough close at hand. At Cubatão, near Santos, 166,000 horsepower have already been installed, and there is a potential capacity of 750,000 horsepower. This is described as one of the world's finest power sites. There are also several other important power plants along the Tieté and its tributaries where they cross the crystalline mountains. This distribution of hydro-electric stations is more the result of the market for power in the nearby urban cluster than of any special abundance of power concentrated in this district. Small power plants are found throughout the state, every small town and fazenda having its own system of electric lighting (Figure 4).

FIGURE 6.—Silk textile factories of São Paulo State, 1929.

The industrial pattern which is related to these things is characterized by the opposed tendencies to concentration in the urban cluster, and to scattering throughout the interior. In general the arrangement of the industries still follows essentially with that of population. Yet the characteristics of each industry produce individual peculiarities of distribution which are lost in a consideration of the aggregate. Let us examine, therefore, a few specific examples.

The factories producing cotton thread

[4] E. L. da Fonseca Costa, "Richesses minérales et houille blanche au Brésil," *Ann. de Géogr.*, Vol. 41, 1932, pp. 618–630; and A. W. K. Billings, "Water Power in Brazil," *Engineering Journ.*, Vol. 13, 1930, pp. 493–503.

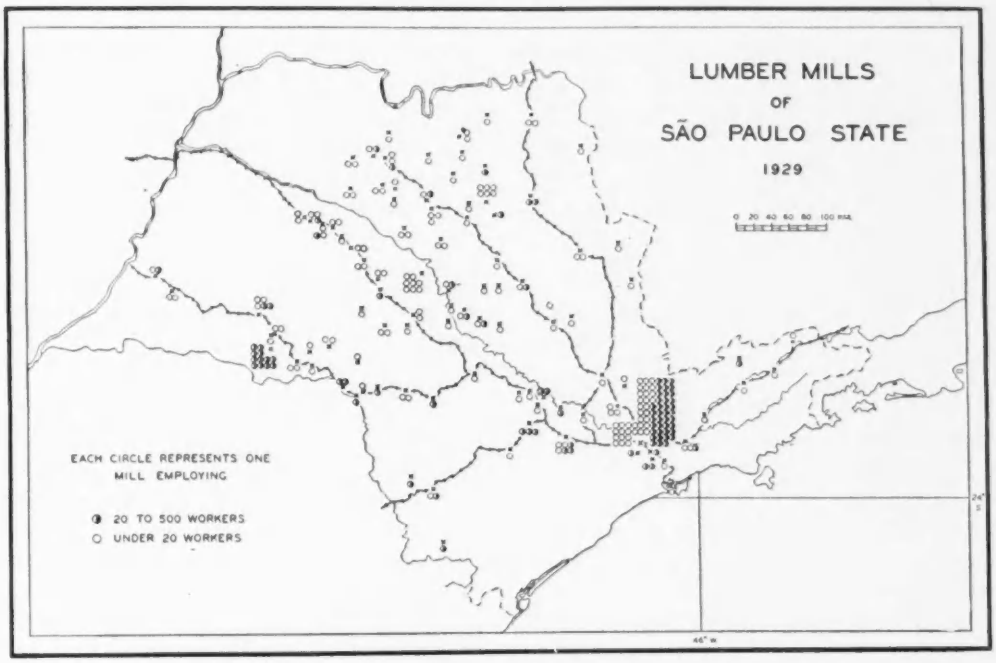


FIGURE 7.—Lumber mills of São Paulo State, 1929.

and cloth are among the most important in the state in terms of value of the product, or amount of capitalization, or number of workers. São Paulo city has eight factories employing more than 500 workers each (Figure 5), and 31 plants of smaller size, employing between 20 and 500. There are also other large units in the neighboring cities of the urban cluster—four in Sorocaba, for example. Yet in spite of this distinct concentration around São Paulo, there is also a scattering of smaller units throughout the interior, following the pattern of population distribution. The large factories in São Paulo city have, in several instances, sought markets outside of the state boundaries, but they have reached them by way of Santos and coasting steamers. We shall return to this remarkable situation presently.

Silk textiles (Figure 6) are made of raw materials of high value per unit of weight. The finished product, too, must be classified under the high value goods. It is not surprising, therefore, to observe the extent to which this industry has become localized in the urban cluster.

In contrast to these textiles, however, are the lumber mills. On the map (Figure 7) no distinction is made between saw mills where logs are converted into rough lumber and the small retail yards where the rough lumber is cut to specified patterns. We may suspect that the numerous small units strung along the rail tentacles in the northwest and southwest are of the former type. Logs are brought to them by ox-team, and the lumber is shipped to the market by rail. The 12 mills in the town of Maracahy in the southwest reflect an abundant source of timber from the new coffee clearings which, in 1929, were appearing in that part of the state. The establishments in the longer settled portions of the state are probably of the second type—located with reference to the market rather than a source of raw material.

The furniture industry (Figure 8) is also still dominated by the small factory and workshop. In São Paulo city there are 174 furniture workshops, each employing less than 20 workers, and most of them selling the products at retail from the front of the same building in which the manufacturing is carried on. The distribution of the furniture workshops also follows closely that of the population, for such bulky products can reach only near-by markets.

One other example of a specific industry is taken from the food and beverage group. Of the breweries (Figure 9) of São Paulo state only one employs more than 500 workers, and this one is located prominently in the city of São Paulo. Its raw materials come from various parts of the state, and from outside the state by way of Santos; and part of its product similarly is sent to outside markets. Yet the cost of transporting beer, which bulks large in proportion to value, is such that the continued existence of numerous smaller plants with local markets in the interior of the state is permitted.

The distribution of all industries exhibits these various patterns in the aggregate. The larger industrial establishments (Figure 10) show a distinct concentration in the urban cluster around São Paulo city. The plants of intermediate size, employing, in this case, between 50 and 500 workers, are also concentrated in this same district; but in addition many of these are scattered throughout the state with a density which parallels very closely the density of population. Still, more striking is the distribution of the small factories and workshops (Figure 11). There are 1,786 such establishments in São Paulo city—many of them of recent origin and competing with apparent success with the large plants nearby. This map reflects quite faithfully the distribution of people.

In other words the large unit factories have not yet by any means established themselves firmly in control of the São

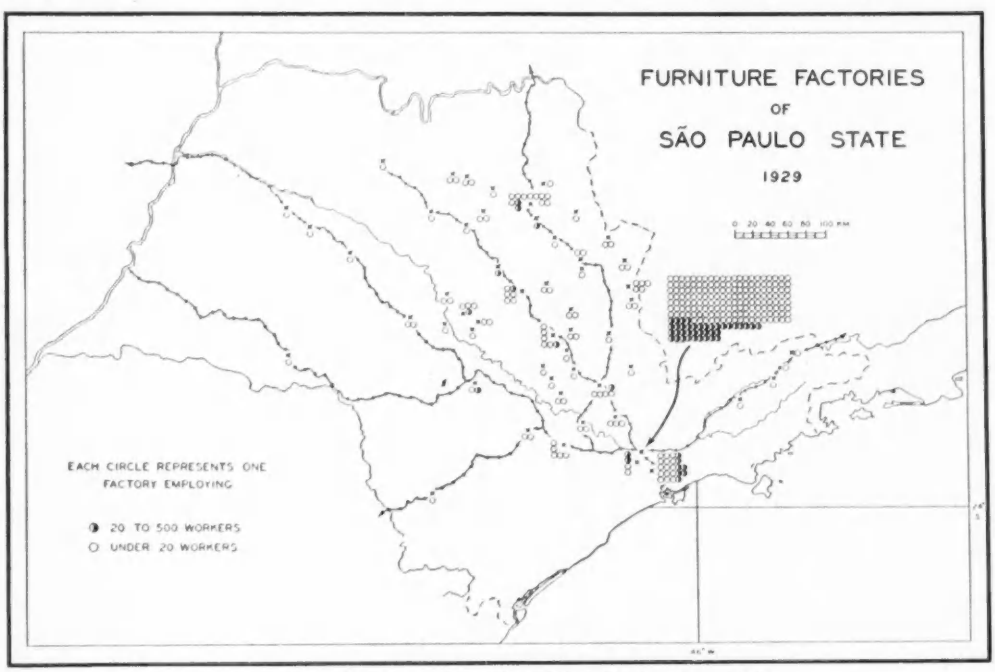


FIGURE 8.—Furniture factories of São Paulo State, 1929.

FIGURE 9.—Breweries of São Paulo State, 1929.

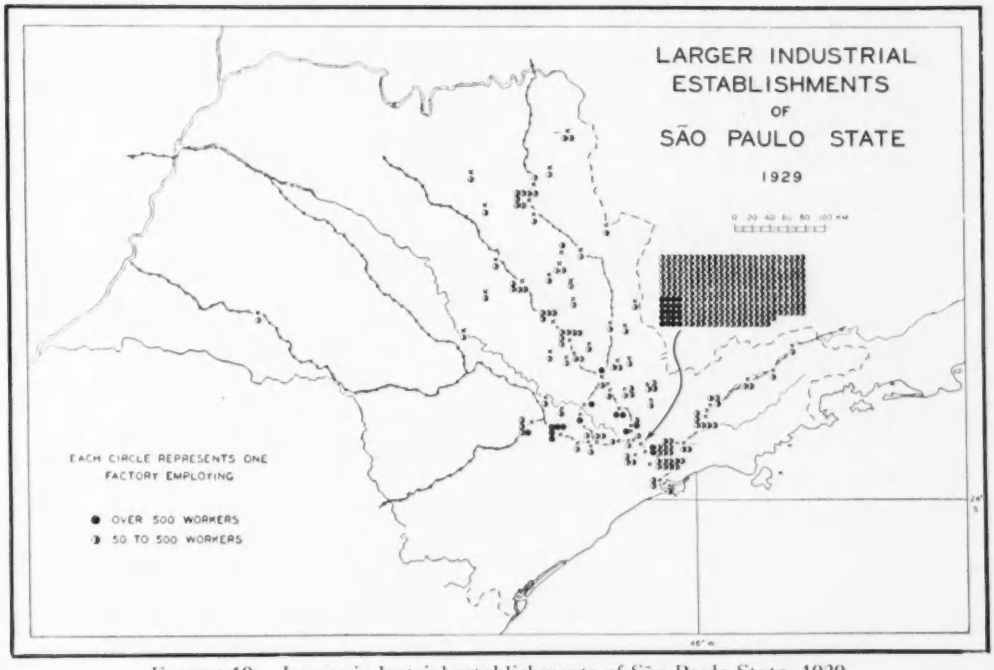


FIGURE 10.—Larger industrial establishments of São Paulo State, 1929.

Paulo commercial hinterland, although the beginnings of the process are indicated by the evidences of localization in the urban cluster. Even today an important part of the industrial structure is composed of the small enterprise with only local market.

We have already pointed out, how-

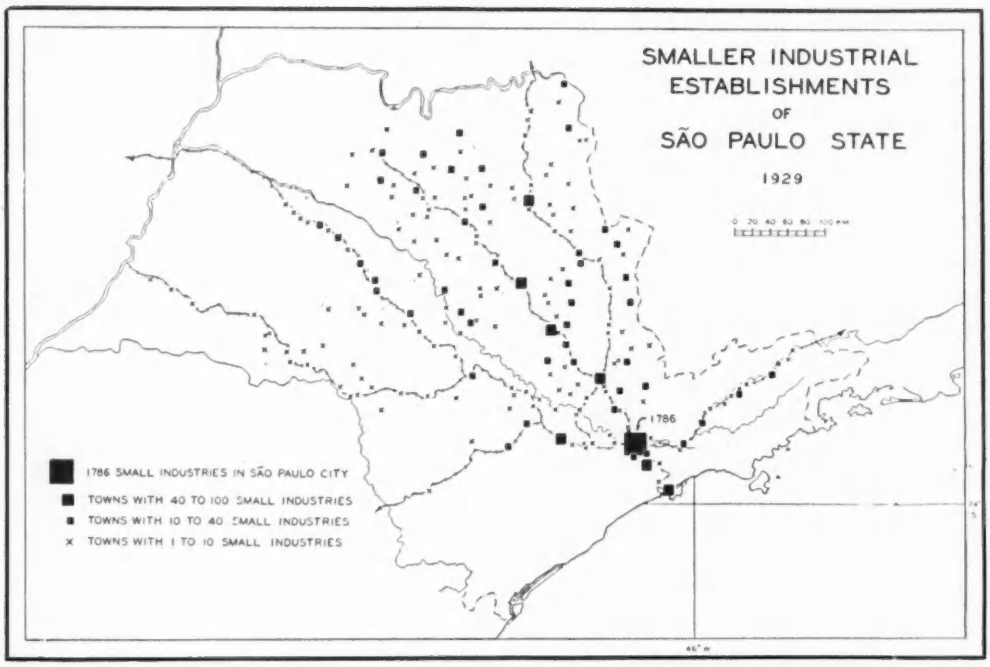


FIGURE 11.—Smaller industrial establishments of São Paulo State, 1929.

ever, that some of these larger units were reaching beyond the state boundaries for both markets and raw materials. São Paulo industries may some day market their products widely in the interior of the country—provided the interior could absorb such products, which it could not do today. But to haul raw materials from Santos some 2,400 feet onto the plateau, and lower the manufactured articles again to the coast for shipment by coasting steamer would seem to require some very special set of factors favorable to industry. As a matter of fact this was accomplished with the aid of a 2% tax on imports levied at all the ports of Brazil excepting Manaos in Amazonas and Santos, and with the aid of a high tariff against foreign made goods. The surcharge was removed with the fall of the Paulista group from political leadership in 1930. São Paulo can no longer maintain this distinctly artificial advantage over the more favorably situated Rio de Janeiro. The hinterland of the latter city is not only the immediate interior, chiefly in Minas Geraes, but also the whole coast from the Amazon to Rio Grande do Sul, with its varied products and important markets for manufactured goods. São Paulo can scarcely compete with Rio de Janeiro for this widespread trade without the aid of special privileges. Industrial growth in Rio de Janeiro is already surpassing that of the inland metropolis.

POPULATION ADJUSTMENTS IN OUR VIRGIN ISLANDS

Earl B. Shaw

THE Virgin Islands of the United States, three small rugged isles, located near the northeast corner of the Caribbean Sea, show marked adjustments to physical and economic factors in the distribution, composition, and decline of their population. Relationships are found between population distribution and topography, climate, soils, cane culture, subsistence farming, grazing, and trade. The early agricultural development of the islands, based largely upon their location in the tropics, has influenced racial composition. And finally, a paucity of natural resources, together with world changes in commerce and industry, has been responsible for the consistent emigration of the last century.

Population Density, Virgin Islands

The Virgin Islands have a population density of 167 per square mile. This average is greater than that of Cuba and the Dominican Republic, but is considerably less than that of Puerto Rico, Jamaica, Haiti, and most of the Lesser Antilles. Grenada, an extremely rugged island, has a density three and one-half times as great, and Barbados a density six times as great.

The United States Virgin group differ significantly in both total and density of population in each island (Figures 1 and 2 and Table 1). St. Croix, the largest, has a density of 135.5 per square mile. St. Thomas has 348.1 per square mile, or more than twice that of St. Croix, and more than three-fourths that of overpopulated Puerto Rico, forty miles to the west. St. John, the smallest island, has a density of 38.3 per square mile, a figure less than twenty-five per cent of that for the group. (Population statistics from the United States Census for 1930; areal statistics from "Notes on the Danish West Indies," *National Geographic Magazine*, Vol. XXX, 1916.)

TABLE I

	Area	*Population*	*Density*
Virgin Islands..	132 sq. mi.	22,012	167
St. Croix	84.25 sq. mi.	11,413	135.5
St. Thomas....	28.25 " "	9,834	348.1
St. John.....	19.97 " "	765	38.3

St. Croix, Rural Population

St. Croix has a larger rural population than either of the other islands. This is less an adjustment to size than to the arable character of the Tertiary coastal plain which stretches in a general northeast-southwest direction between the cretaceous uplands to the northwest and east (Figure 3). On this nearly level area sugar cane has been raised for hundreds of years. Negro villages dot the landscape and house the workers who supplement with hand labor the machine cultivation made possible by favorable topography. However, not all of the plain possesses topography suitable for machine agriculture. Slight arching and differences in rock composition have produced an arc-shaped cuesta in the northeastern portion. A comparison of the population map and that for topography shows clearly how this difference in physiographic history and consequent difference in topography have influenced population density. The cuesta section, because of its rolling character, has been given over to cattle raising, an extensive type of industry

with small labor requirements and an ability to utilize rugged land; and this difference in land utilization is reflected in the sparse population shown on the map.

Cattle raising is also the dominant industry in the rugged northwest upland in spite of the heaviest rainfall of the island and in spite of sections of better-than-average soils. There are a few exceptions to this prevalence of grazing, however, the major one being around Annaly where a group of negro squatters raise provision crops and hand-cultivated cane. This small island of comparatively dense population on the highland is largely a response to a local occurrence of rich clay. Nevertheless, even this small concentration of population lacks the density of that of the plain, while the general average for the highland is much less.

Most of the eastern upland, like the maturely dissected northwestern section is given over to grazing, and hence is sparsely populated. Largely because of better care, the best pastures of the island extend for two or three miles east of Christiansted. Beyond that section, the scantiest rainfall of St. Croix, probably a result of low elevation and the narrowing of the island, combines with rugged topography to bring about a different type of land utilization. Here, where the terrane is too rugged for machine cultivation and the moisture too limited for sustenance farming or good grazing, the land has reverted to thorn woodland. Uninhabited, the thick thorny vegetation provides a retreat for animals gone wild through many years of freedom. Cattle, hogs, goats, and donkeys share this woodland with a few indigenous deer.

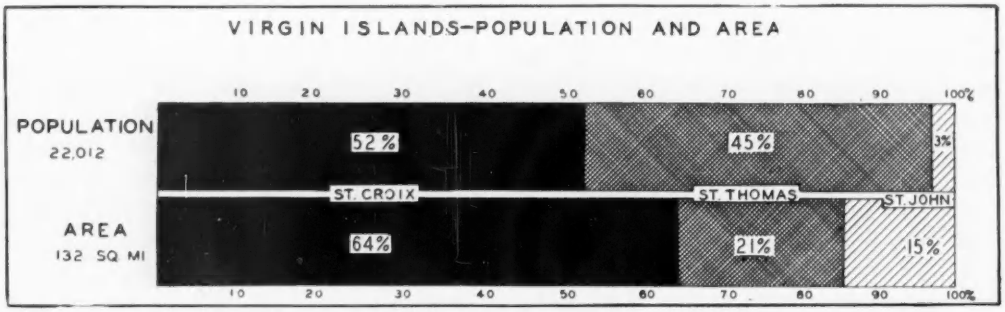


FIGURE 1.—A graphic comparison of the populations and areas of the Virgin Islands reveals the relative density of population upon them. With considerably less than one-fourth of the area of the Islands, St. Thomas includes almost half the population; St. Croix, with almost two-thirds of the area, has slightly more than half the population; and St. John, with one-seventh the area, has one-thirty-third of the population.

ST. CROIX, URBAN POPULATION

The urban population of St. Croix is concentrated in the towns of Christiansted and Frederiksted, the former near the center of the north coast and the latter on the west coast. These towns include half of the island's population. Both have been seats of island government, and the old red forts, easily seen from an approaching ship, are used for municipal purposes.

Christiansted owes its location to geographic factors which were favorable to port development in early days. The small section of coastal plain bounded by an amphitheatre of hills on the east, south and west, not only makes a picturesque setting for the town, but the upland background offers possibilities for well-located fortifications. Moreover, a passage through the low hills to

the southwest provides easy access to the broad stretch of arable land beyond. Although located on a windward coast, the town lies in the lee of Protestant Cay and the harbor basin is protected from heavy seas by Scotch Bank and Long Reef. Furthermore, the harbor is deep enough for the sailing ships which dominated the seas in colonial time, and permitted the loading and unloading of cargo on the wharf.

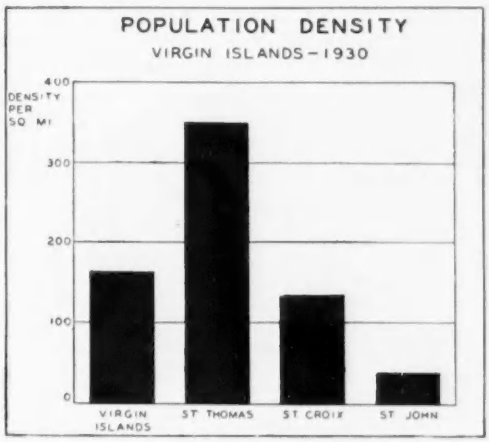


FIGURE 2.—The people of the Virgin Islands have plenty of "elbow room," areally speaking, and population density does not approach that of Barbados. It is probable that the geographic background of Barbados provides a more stable basis for a density of approximately one thousand per square mile than does the more limiting environment of the Virgins for a population of only one hundred and sixty-seven.

But some of the geographic factors which offered no handicap to commerce in early days are not so favorable to modern means of transport. Sailing vessels still unload at the wharf and find little difficulty in negotiating the narrow passage which leads to the protected shallow embayment; yet ships of this type no longer carry the major part of the world's ocean cargo. Today is the day of the steamship, and the narrow tortuous channel and the basin of scarcely twenty-foot depth permit only small steamers to call at the port; and then at such a distance from shore that lightering is necessary. Consequently the town has lost its early position as the focal point for St. Croix's shipping.

At Frederiksted no embayment or natural harbor offers shelter for ships, but an open roadstead along the Virgin Passage provides anchorage for the largest boats not far from shore. Location on the north-south trade route along the Lesser Antilles to South America was, no doubt, an important factor in the choice of town site. An influence even more critical may have been the protection from strong winds afforded by the upland section to the northeast of town. Along the west coast in the lee of the upland, navigation was safer for sailing vessels, and a leeward position was important in site location for Frederiksted just as it was for many other early towns of the Antilles. Another less critical factor was the nearly smooth topography to the southeast, affording easy access to the cane-growing section. As a result of location along a regular north-south trade route and the advantage of deep water near shore, Frederiksted has gained slightly in population since 1835, a decided contrast to Christiansted whose population has fallen consistently during the past century.

ST. THOMAS, RURAL POPULATION

St. Thomas is a maturely dissected upland of cretaceous age, with angular ridges extending in a general east-west direction and gradually declining from west to east (Figure 4). Largely as a response to this general occurrence of rugged topography and a lack of any significant tract of arable land, rural population is sparse (Figure 4). Whereas topography is undoubtedly the critical factor limiting population density, soils add strength to this negative influence. With the exception of the soils found in the valleys of the intermittent streams—there are no perennial

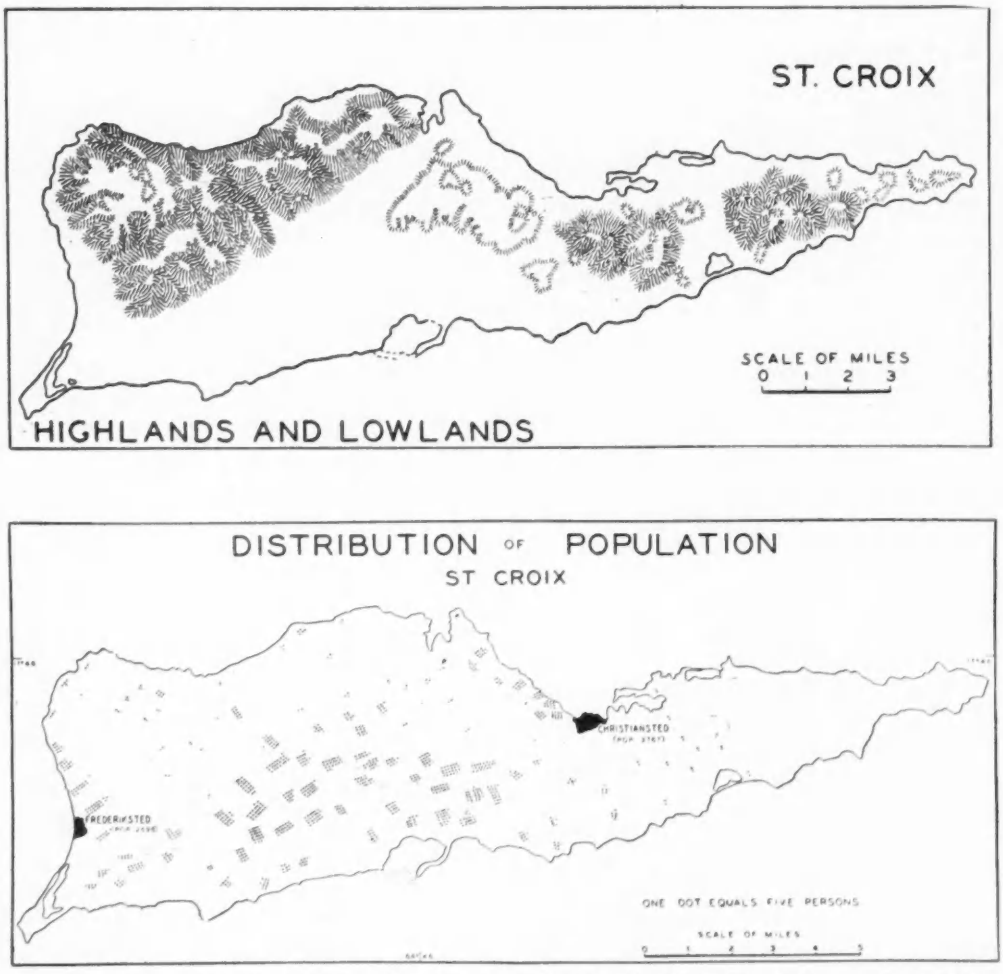
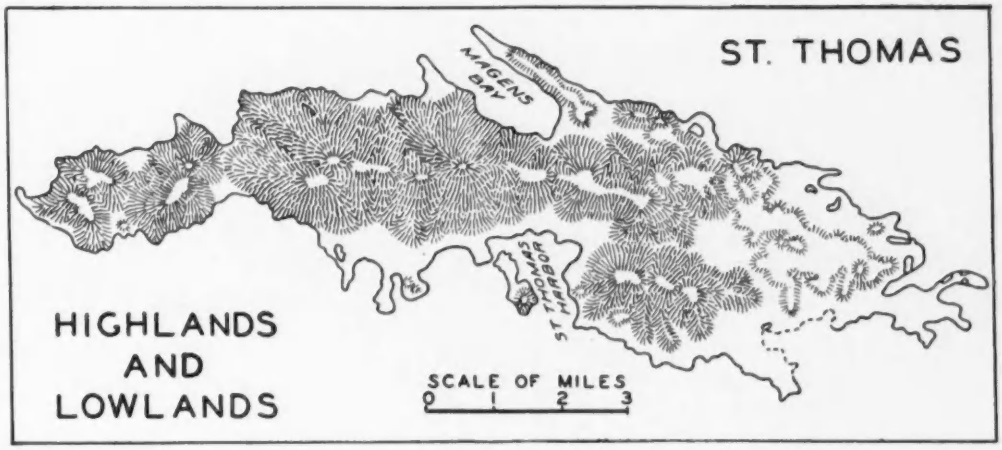


FIGURE 3.—A comparison of the relief and population distribution of St. Croix reveals a striking relationship between the gently rolling lowlands of the Tertiary coastal plain and the greatest density of rural population. The population dots in St. Croix's sugar region agree with the more or less regular arrangement of each of the negro villages found there. On the plantations are stone or frame houses, generally in rows, for the Negroes who work in the cane fields.

streams in St. Thomas—soils are generally thinner and possess less fertility than those of either St. Croix or St. John. Precipitation, unlike topography does not limit settlement; for St. Thomas' rainfall is as heavy as that of the coastal plain of St. Croix where population is denser.

Slight differences occur in the general sparsity of rural population and these departures from the average are associated primarily with small differences in the general background. In the east, the region of least relief, a considerable area is seeded to Guinea Grass (Figure 5), which provides good grazing for the major portion of St. Thomas' cattle. Although this industry has small labor requirements, a greater concentration of people is found in the east than in the western part of the island where the more rugged terrane has reverted largely to thorn woodland. Moreover, two of the big cattle raisers specialize in raising milk cows for the Puerto Rican market, and this phase of the cattle business de-



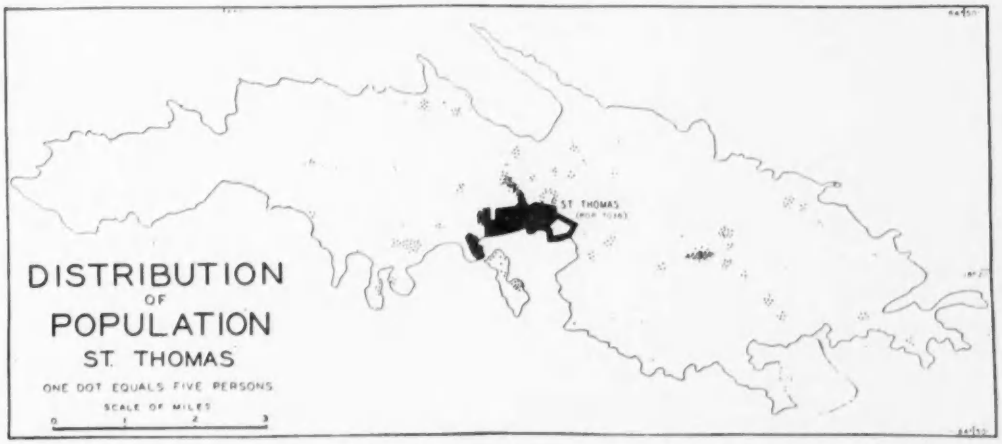


FIGURE 4.—The good harbor which indents the southern coast of strategically located St. Thomas has influenced a port development accounting for three-fourths of the island's population. With scarcely five hundred acres of arable land out of a total of approximately eighteen thousand acres, it is not difficult to see why St. Thomas does not support a dense rural population.

mands more workers than a phase devoted entirely to beef production. Furthermore, the less rugged topography of the east, which permits easier cultivation of the land and favors better roads, has encouraged more sustenance farming. On the north central portion of the island where a windward location causes heavier precipitation, small settlements of French raise fruits and vegetables for the St. Thomas port market.

ST. THOMAS, URBAN POPULATION

Unlike St. Croix, St. Thomas has but one town, yet it totals a larger population than both Christiansted and Frederiksted and includes three-fourths of the island's people. Such a concentration is related directly to the harbor which for centuries has been known as one of the best in the Caribbean region (Figure 6). This embayment was selected for port development from the many bays and inlets which indent the submerged shoreline. The choice was made because of a depth sufficient to accommodate large ships, an expanse of anchorage ample for many vessels, a mountain background offering favorable sites for big gun emplacement, a pro-

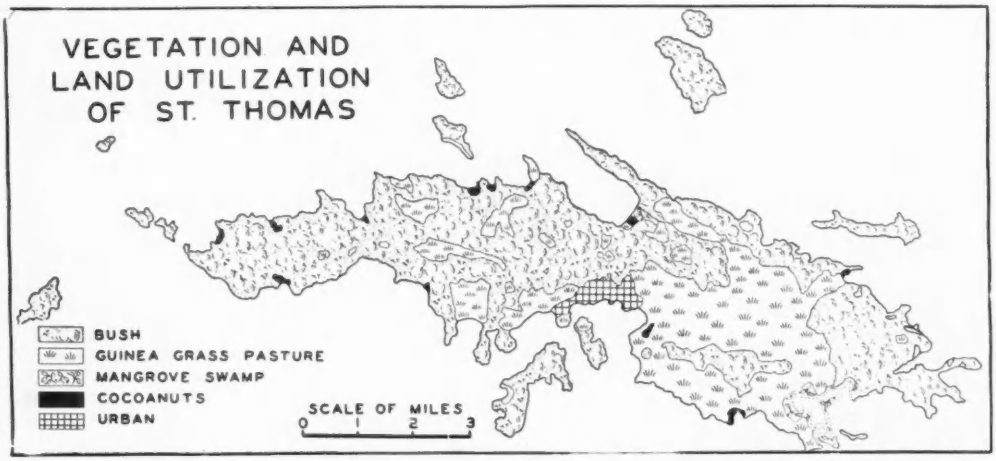


FIGURE 5.—The planting of improved grasses in eastern St. Thomas is largely a response to a relief less rugged than that of the west. In that section, thorn woodland, known locally as "bush" is the dominant type of vegetation. Small cocoanut groves line the shores of a few coastal indentations. Around lagoons mangroves are found.

tection from storms through an almost landlocked leeward location, and ample space for wharfage facilities on an easily accessible waterfront. Moreover, the rise to the most important and largest town of the Virgins was made in competition with a harbor equally as deep, wide, and storm-protected at Coral Bay, St. John. This rise may be explained by the earlier settlement of St. Thomas, its nearness to Puerto Rico, a location not far from the Virgin Passage and an importance as the seat of the Islands' government.

Besides the concentration of people at the port of St. Thomas, there is a small suburb just outside the boundary of New Quarter, of which St. Thomas port forms the major part, known as Carenage. The people here are French fishermen. The comparatively shallow waters above the submarine bank surrounding St. Thomas abound in fish and the location of the village near the outskirts of the port makes a good market easily accessible. A plentiful fish supply, a market, and the unsuitability of the hinterland for crop agriculture account for the concentration of population at Carenage.

ST. JOHN, POPULATION DISTRIBUTION

Without a port development similar to that of St. Thomas, without a stretch of agricultural land like St. Croix's coastal plain, and without a location on the main routes of trade, St. John lacks the basis for even a moderately dense population. Yet the small number of people (Figure 7) are well adjusted to the physical background. The maturely dissected cretaceous upland, making up the greater portion of the island, and the moderate, poorly-distributed rainfall are ill-suited for machine agriculture. Hence, cattle raising, forest industries, chiefly bay leaf gathering, sustenance farming, and fishing are occupations well adapted to the natural environment and provide a low standard of living for the small population. The majority of the people are found along the irregular shore line. The coastal location provides advantages for fishing, for raising provision crops on the small stretches of nearly level land, and for boat transport. A slightly heavier population density is found at Coral Bay and Cruz Bay on the east and west coasts of the island. The presence of a good, yet undeveloped harbor,

a broad shallow bank area to the south affording excellent fishing, and a small manufacture of bay oil furnish the basis for the small grouping at Coral Bay. The nearness to St. Thomas and the location of the government representative at Cruz Bay, probably account for the village at that point. Population distribution is further influenced by various trails—St. John has no roads—the bay leaf development on Bordeaux Mountain and the better grazing lands on the east and northeast portions of the island.

FIGURE 6.—St. Thomas Harbor, on the south coast of St. Thomas, is ten miles east of the Virgin Passage. The northern and eastern limits of the harbor are marked by St. Thomas Island and the western limit by Hassel Island, part of which may be seen in the right foreground. The harbor entrance, which opens to the south, is approximately five hundred yards wide, and broadens northward into a basin about three-fourths of a mile across. The embayment, almost landlocked, is a safe haven for ships. Tides are no handicap, for the mean range is less than a foot.

COMPOSITION OF THE POPULATION, VIRGIN ISLANDS

The major factor influencing the composition of the people (Figure 8) is the large number of negro slaves which, in early colonial days, were brought from the Guinea Coast of Africa to work on the sugar plantations. At first, the colonists tried to use indentured servants and criminals whom they brought with them from the home land. But the settlers found, just as others have discovered who have attempted to use white labor in the tropics, that, in general, the white race does not lend itself well to hard labor in a tropical lowland environment. After this failure, the planters purchased Negroes by the thousands, and their descendants make up a large part of the present colored population. The remainder of the colored people have come either from the British Islands or are descended from Negroes brought from there under contract and colonization schemes after 1848, when emancipation became effective in the Virgins. The United States census for 1917 listed 4,267 persons who gave the British West Indies as their birthplace.

Strange as it may seem, in view of the two hundred years of Danish sovereignty, not many people of Danish descent lived on the islands when the United States bought them. Several Danes have left since the change of ownership. Nearly as large an element among the white population are of British descent. When Denmark took over the colonies, an invitation for settlement was extended to the planters on the neighboring English isles. Many of these farmers accepted the offer, and some of their descendants remain. Moreover, English is the language of nearly all the people in the Virgin Is-

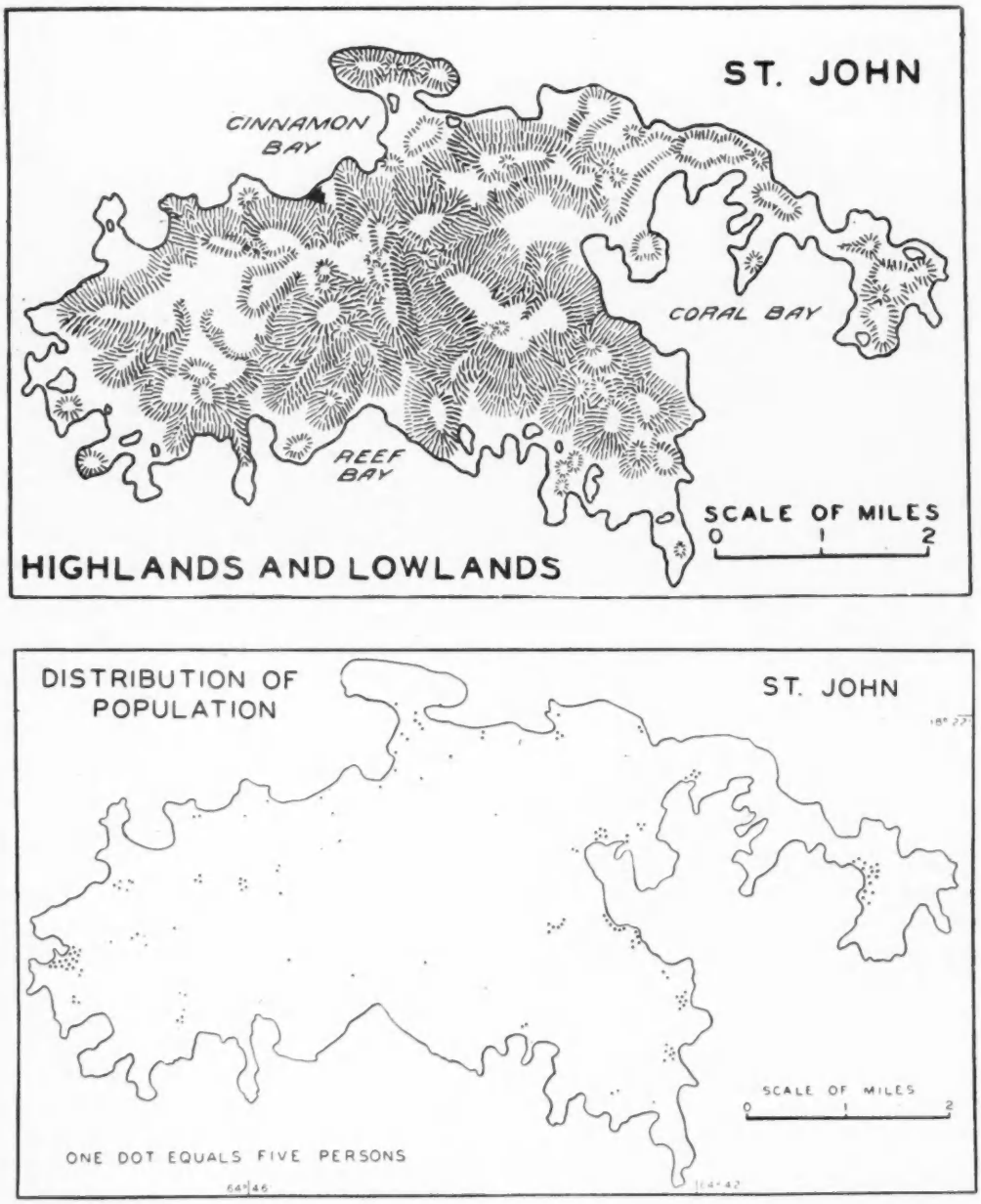


FIGURE 7.—Physiographically, St. John may be described as a maturely dissected upland. The highest elevation, approximately 1,250 feet above sea level is slightly lower than the highest point in St. Thomas, about 1,550 feet above sea level, and loftier than the topmost level in St. Croix, about 1,100 feet above sea level. Most of the population live near the coast.

lands. This probably can be explained by the fact that much of the Islands' business has always been associated with shipping and English is the language of the sea. Again, as previously indicated, many of the Negroes came from the British West Indies and this had an important influence.

Approximately eight hundred French are included in the white population of St. Thomas. The most of these "Chachas," as they are called, are either emi-

grants or descendants of emigrants who came to St. Thomas from St. Bartholomew and St. Kitts, French West Indies islands, several decades ago. The majority of the French live in Carenage, and as pointed out above, make their living by fishing. The remainder, located largely on the north side of the island, are fruit and vegetable farmers. Both fishing and farming "Chachas" have maintained their racial purity for generations and the colony forms one of the few pure white groups of the Caribbean tropics.

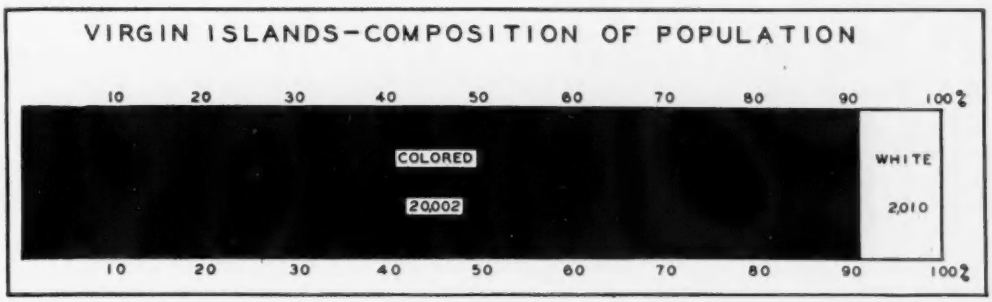


FIGURE 8.—The pure white group forms a small percentage of the Virgin Islands' population.

Within recent years a number of Puerto Ricans have emigrated to the Virgin Islands (in 1930 seven hundred and thirty-one people gave Puerto Rico as the place of their birth), the major portion settling in St. Croix where frequent labor troubles have given the immigrants work in the cane fields. If sugar continues the dominant St. Croix crop, this immigration may favor the industry. The Puerto Rican immigrants, in general, are more ambitious and efficient than the natives and these characteristics should offset the problem of difference in language, customs, and race that opponents to the immigration suggest as arguments against the use of Puerto Rican labor.

The population of each of the Virgins is dominantly colored. Each island received an influx of slaves in early colonial days. St. John has only six white people. The small white element results from the absence of plantations requiring white managers, no urban centers, and no significant shipping or regular contact with the outside world. Less than four per cent of the people of St. Croix are white. The white management of the sugar plantations, government officials from the continent, and several of the trades people make up this small number. Two-thirds of the white people of the Virgins are found in St. Thomas. This is largely an adjustment to shipping, to the presence of the French colony, and to the fact that St. Thomas is the main center of government for the Virgins. The white population is made up of the "Chachas," government officials from continental United States, commercial representatives from foreign governments, and many trades people.

POPULATION DECLINE, ST. CROIX

The decline in population in St. Croix has paralleled closely the decline in the island's sugar industry. St. Croix's sugar business did not "go down" under the early blows which caused the abandonment of sugar on the more rugged isles of St. Thomas and St. John; for St. Croix's arable coastal plain permitted the use of agricultural machinery, an economy which was not possible on the dissected uplands of the smaller Virgins. Yet, in spite of this and other economies

that were made by the planters of St. Croix, sugar production showed a small but consistent decline until the turn of the twentieth century, and during the last thirty years has fallen off sharply. The reasons for this decrease are not

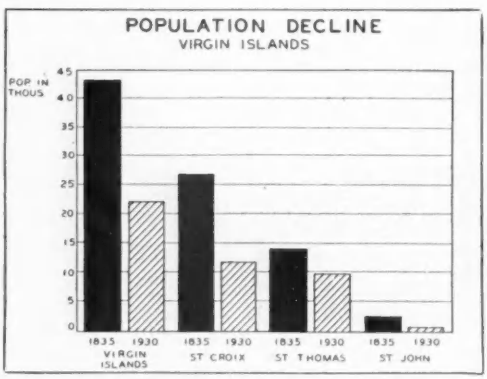


FIGURE 9.—The early part of the 19th century marked the peak of the Virgin Islands' economic development and the high point in population. This period was before beet sugar production got well under way in Europe, before East Indian cane growers expanded their acreage significantly, before the emancipation of the Virgin Islands' slaves, and before the steamship began to encroach upon the sailing ship commerce of St. Thomas. The population of the Virgin Islands in 1930 was only 51 per cent of that in 1835.

hard to discover. Inadequate, poorly distributed rainfall has always been the major handicap to cane yields in St. Croix; and, together with other less vital drawbacks, has made for a high production cost and an inability to meet the competition of areas more ideally adapted to sugar raising, and consequently better able to make money on an unusually low price scale. (*St. Croix: A Marginal Sugar Producing Land*, Shaw, Earl B., *Geographical Review*, Vol. XXIII, No. 3, July 1933, pp. 414–422.) Today thousands of acres, in cane a century ago, support herds of cattle, and many of the people who tended the sugar fields have found work elsewhere. In 1835 the rural population was 18,558; in 1930, 4,948. The numerical decline was 13,610, the greatest numerical loss of any of the Virgin Islands (Figure 9); the percentage decrease was 73.3 per cent and the per cent of total population decrease was 89.2 per cent.

Urban population in St. Croix did not decline as rapidly as that of the farming section. Christiansted lost significantly because of location and lack of a good harbor, but, as previously indicated, Frederiksted showed a small gain for the century. In 1835 Christiansted and Frederiksted had a population of 8,123, the former having 5,806, the latter 2,317. In 1930 the census figure for Christiansted was 3,767, that for Frederiksted 2,698, with the total urban figure 6,465. The numerical decline for the towns was 1,658, the percentage decrease 20.4 per cent and the per cent of total loss 10.8 per cent.

The figures show clearly what section suffered most in St. Croix's century long decline. The farming region lost its people with the decrease in sugar production. The towns retained their population better because they not only formed a small per cent of the total population in the boom days, but some of their emigration loss was made up by replacement from the farms.

POPULATION DECLINE, ST. THOMAS

The decrease of population in St. Thomas during the past century has been less severe than that in St. Croix. Probably the lesser emigration may be accounted for by the fact that the northern Virgin has a better location with reference to trade routes, a good harbor, the seat of the Virgin Islands' government, a shipping business which has declined, yet no more seriously than the sugar industry of St. Croix, and finally a small, yet developing, manufacturing industry in bay rum and in handwork products. The census of 1835 listed 14,022 people, whereas that of 1930 showed 9,834. The numerical decline

was 4,188, the percentage loss 29.8 per cent. Practically all the decline took place in the port city, 94.8 per cent. The town had a population of 11,071 in 1835, the zenith period of its sailing ship commerce and entrepôt trade. The number for 1930 dropped to 7,036, a total decline of 4,035 and a percentage loss of 36.4 per cent. This loss of the past century is closely associated with the decline in shipping. St. Thomas has one of the best harbors in the Caribbean and, due to this advantage and to a strategic location, the port was one of the main shipping centers of the West Indies in early days. Many changes have occurred which have lessened this early importance. The invention of the steamboat, radio, wireless, refrigeration, sea water condensers, and of engines capable of burning fuel oil contributed to the city's decline. The development of other islands to the point where they could import and export in ship loads without the aid of an entrepôt was a serious blow. Other unfavorable influences include the departure of the Hamburg-American Line with the purchase of the island by the United States, the discontinuance of the use of St. Thomas as an outfitting point for Latin American revolutions when Denmark relinquished control, and the granting of subsidies and patronage by foreign countries as aids to their colonial ports in the West Indies. All these changes have damaged the shipping business of St. Thomas; and with the decline in shipping an exodus of population began.

The decrease of only 5.2 per cent in rural population during the last century, 2,951 to 2,798, is the smallest decrease of any rural section of the Virgin Islands. An explanation of this is not hard to find. St. Thomas never did develop a sugar industry of much importance. Consequently, when the rugged hills could no longer compete with better favored regions, the upset to rural economy was not severe. Some planters and farm laborers moved to the port city or left the island, but others turned to cattle raising and sustenance farming. Within recent years, several urban families, unable to find employment, have taken small rural plots, where, in spite of climatic, topographic, and soil handicaps, crops can be raised. The government is favoring this movement with a homestead plan, and has purchased a few hundred acres for distribution to the people.

POPULATION DECLINE, ST. JOHN

St. John, always entirely rural, has made the greatest proportional decline in total island population of any of the group (1835—2,475 people; 1930—765 people; decrease 1,710 or 70 per cent). In 1835 St. John's sugar production adequately supported the much larger population, but with the coming of competitive changes unfavorable to hoe culture on the rugged upland, the industry rapidly decreased and most of those dependent upon it left the island. They had no port city with a significant shipping development and no local market for provision crops. Consequently, there was little to discourage emigration.

The greatest decline took place between 1835 and 1880, for by the latter year the census showed but 944 people on the isle. Since then there has been little change. In fact, of all the Virgins, St. John is the only one where resources, stage of industrial development, and number and type of population have reached a more or less stable equilibrium.

POPULATION DECLINE, THE VIRGIN ISLANDS AS A GROUP

With the exception of 1850 and 1860, the whole Virgin group declined in population at each succeeding census after 1835. This gives conclusive evi-

dence that the decrease is by no means peculiar to the United States ownership. Emigration began when high sugar profits became impossible on these marginal cane producing islands. When smaller sugar acreage provided less work for the laborers, there were few chances in other local occupations. Cattle raising and shipping gave scant encouragement for employment. No manufacturing, no mineral industry, and no substitute plantation crop for sugar held back the worker when outside calls came for labor; and after the turn of the century the higher wages offered in continental United States and in Caribbean fruit culture and petroleum exploitation accelerated an emigration already well started.

Unlike the decrease under Danish control, which numbered among its causes the increase of deaths over births, no portion of the loss under American ownership may be found in the vital statistics. The figures for the decade 1902 to 1911 inclusive show an excess of 937 deaths over births. The total decrease in population for the ten years was 3,441, so that the high death rate accounted for more than one-fourth of the decline. This was under the Danish régime. In contrast, the figures for fourteen years of United States ownership, 1917–1931 (Figure 10), give the birth rate a definite advantage over the death rate.

A most important factor accounting for the exodus under American ownership has been the ease with which Virgin Islanders gain residence in continental United States. Not only native Virgin Island inhabitants, but those aliens who are legally resident as well have practically unrestricted right of entrance to the United States mainland. This privilege, in view of the more profitable opportunities available on the continent during the first twelve years of American control over the Virgins probably accounted for a large per cent of the northward movement.

Until recently the school curriculum has influenced this movement to continental United States through laying great emphasis upon clerical studies and almost none on agriculture, the major industry of the islands. It is easy to

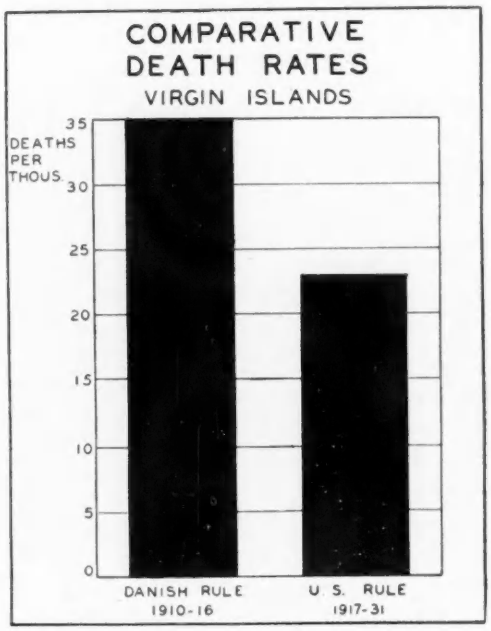


FIGURE 10.—Health conditions have shown improvement since the change of sovereignty from Denmark to the United States. In 1917, the last year of Danish ownership, the death rate was 41.5 per thousand, whereas in 1931 the rate was 20.4 per thousand.

show a direct connection between the type of education given and a subsequent desire to leave; for between 1921 and 1928 nearly one-fourth of the pupils who graduated from high school left their native land.

There will likely be less emigration in the immediate future, for new emphasis on school work trends towards agricultural subjects and vocational training. Moreover, the world-wide depression allows little opportunity for a job to the emigrant. He cannot improve a bad situation by changing locations. How-

ever, if the port activities of St. Thomas and the sugar business of St. Croix continue to decline, or even remain as they are, these islands have a surplus population. The grazing industry will not absorb any of the excess, for it is an extensive type of occupation with small labor demands. At present it occupies eighty per cent of the land and employs but three per cent of the labor. Bay rum production, the only expanding manufacturing business in St. Thomas in the last two decades, employs but seventeen people and further expansion offers little solution to unemployment. Fishing will require few additional workers, for there is no possibility for export, and local markets are often over-supplied. The attraction of a tourist industry would improve conditions by stimulating retail trade and increasing the demand for servants; but world-wide depression and local handicaps inhibit a significant resort development at present. Handwork industries may offer employment to some and the government homestead plan may aid. But regardless of the industrial alternative chosen, government aid will probably continue as it has every year that the United States has owned the islands. This monetary extension may postpone further population decline, but when outside areas again offer opportunities for laborers, emigration from St. Croix and St. Thomas will, no doubt, continue until these islands strike a population balance in keeping with their resources.

CITIES OF THE PUGET BASIN

George T. Renner

THE Puget Basin exhibits the unusual phenomenon of numerous urban formations set in the midst of a well-nigh pioneer landscape. Sixteen of these possess a population of 10,000 or more, four exceed 100,000, and one is approaching the half million mark. Three of these cities are situated in British Columbia, two in Oregon, and eleven in Washington. The fact the state of Washington contains only fifteen cities exceeding 10,000 in population and that eleven of these lie in the Puget Basin, suggests that city producing factors are inherent in the natural environment of this region.

The Puget Basin

The Puget Basin is one of the most sharply delimited natural regions in North America, and is possessed of marked geographic individuality. It is a long trough-like lowland or intermontane depression extending in a north-south direction across western Washington. On the south it merges into the Willamette Valley of Oregon, while at its northern end in British Columbia it is submerged to form the large sound known as Georgia Strait. This region is distinctly peripheral as regards the remainder of the United States; from even adjacent areas it is relatively isolated by the Cascade Mountains. The Puget Basin is approximately 300 miles long and varies from 40 to 75 miles in width. On the east it is confined by the Cascades, while on the west the Coast Ranges form a fairly continuous wall.

Avenues of Access

Access to the Puget Basin may be had at ten points. One of the avenues of approach leads southward through the Willamette Valley and by way of Grants Pass to California. A second leads northward to Alaska through the Inside Passage. Three provide access from the Pacific Ocean on the west, Grays Harbor and the Chehalis Valley, the Columbia Estuary, and the Strait of Juan de Fuca. From the east there are five approaches to the Basin: the Columbia Gorge at the south, the Fraser Valley at the north, and Stevens Pass, Snoqualmie Pass, and Stampede Pass near the center.

Puget Basin Cities

The following cities arranged in order of population magnitude according to the 15th Census, 1930, are located within the region:

Name	*Population*
Seattle	366,000
Portland	302,000
Vancouver (B. C.)	254,000
Tacoma	107,000
Victoria	38,000
Grays Harbor	36,000
Bellingham	31,000
Everett	31,000
New Westminster	18,000
Kelso-Longview	17,000
Vancouver (Wn.)	16,000
Centralia-Chehalis	13,000
Olympia	12,000
Port Angeles	10,000
Bremerton	10,000
Astoria	10,000

Causes for These Cities

The existence of a city is always to be accounted for in terms of group adjustments to the natural environment. In some instances this adjustment is manufactural, in others saxicultural, and in still others agricultural, commercial, or of some other type.

The cities of the Puget Basin are certainly not saxicultural, for the reason that there is a paucity of mineral re-

sources other than low-grade bituminous coal. Neither are they manufactural cities. Indeed, the basic manufactories, —iron and steel, textiles, machinery, and chemicals, are practically nonexistent. Waterpower resources are enormous but scantily developed. Forest and fishery resources are rapidly being depleted. Lumber milling and fish canning are important lines of manufacture, but they are centered mainly in semi-rural communities and hence are not primarily responsible for these cities.

Neither have the urban formations of the Basin developed as agricultural market centers. The region is not fundamentally suited to agriculture. It manifests the drier phase of the Temperate Marine Climate, subject, however, to occasional short periods of continentality. The natural vegetation is a heavy fir-hemlock-cedar forest, exceedingly difficult to clear. Soils in the main are immature gray-brownerths of low fertility. As a consequence, agricultural development is not extensive. Rather it is centered on the small deltas and flood plains of such rivers as the Skagit, Nooksak, Cowlitz, Snohomish, and Puyallup. The total agricultural activity of these few small districts is incapable of maintaining market centers of any considerable size or number. Indeed, there are in the entire region less than 400,000 people dwelling on farms and in towns of less than 1,000 population. One must conclude, therefore, that these cities are commercial in their ecology and that they have resulted from both regional and extra-regional adjustments in commerce.

Commercial cities are invariably products of a complex factor of the natural environment, which is usually termed geographical location, and which includes position, accessibility, and vicinal, as well as relative, elements. The existence of commercial cities in the Puget Basin is, therefore, very largely explainable in terms of the region's littoral position and its access with respect to oceanic and continental trade routes. Had there here existed a single indentation of the coastline and but one major line of communication with the interior it is logical to suppose that there would have resulted a single urban agglomeration with a population of 1,571,000. This has

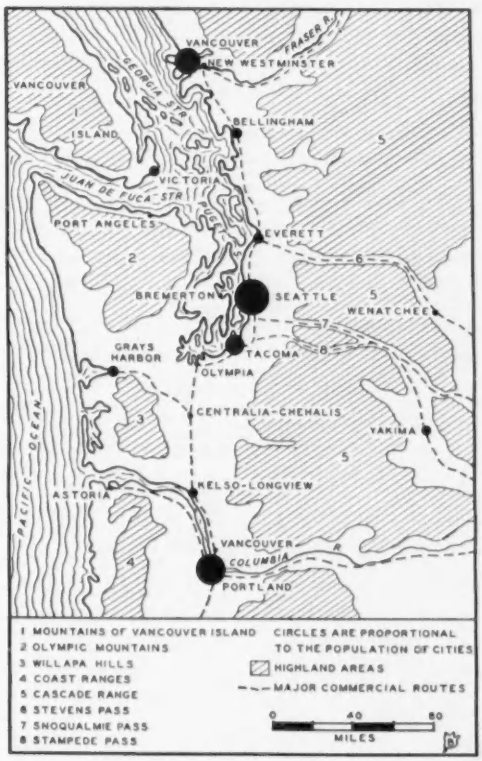


FIGURE 1.—The Puget Basin and its cities. Shaded areas represent highland, usually exceeding one thousand feet in elevation. Size of dots is proportional to population of cities. Major commercial routes are indicated by broken lines.

not been the case, however, for the qualities of relative location within the region have so operated as to disseminate this population into sixteen separate urban units.

CITIES IN A LINE

A glance at the accompanying map serves to show that eleven of the sixteen

cities lie in paternoster fashion along the major or N-S axis of the Basin. This axis is truly a commercial artery, for it consists of railway and highway throughout its length and of navigable waterway through three-fourths of its length. So strategic is relative location upon this line, that no city exceeding 40,000 has been able to develop within the region unless situated thereon.

SEAWARD INGRESSIONAL CITIES

Each of the three seaward approaches to the Puget Basin supports an urban formation. Upon the estuary of the Columbia stands Astoria. In spite of Astoria being older than its neighbors, it is doomed to remain small in size, because Portland, located nearly a hundred miles up the river, has, by dredging a channel to the ocean, become an inland seaport.

At the inner end of Grays Harbor, which is in reality the estuary of the Chehalis River, lies the geographical city of Grays Harbor. This is functionally a unit but consists of the politically separate entities—Aberdeen, Hoquiam, Montesano, and Cosmopolis.

The urban development on the Strait of Juan de Fuca is divided into Port Angeles on the American side and Victoria on the Canadian side of that approach to the Puget Basin. Port Angeles is a small city, but Victoria has attained considerable importance because it serves as a provincial capital and as the local metropolis of Vancouver Island.

LANDWARD INGRESSIONAL CITIES

Each of the landward approaches to the Basin has, at least in part, created a city. At the points where the Fraser and the Columbia Rivers enter the region stand Vancouver and Portland respectively. Stevens Pass to all intents and purposes terminates in Everett, Snoqualmie Pass ends at Seattle, and Stampede Pass at Tacoma. These mountain-pass cities are displaced westward from a normal piedmont position in order to be on the N-S axial route through the Basin.

On the opposite side of the Cascade Mountains, the cities of Kamloops, Wenatchee, Ellensburg, Yakima, and The Dalles guard the eastern approaches to these five entrances to the Basin. Beyond these, Calgary, Spokane, and Boise constitute an outer line of foci for trans-Cascadian trade.

NODAL CITIES

Although the majority of the cities of the Puget Basin lie along the N-S axial highway, not all points on this line are possessed of equal locational quality. Small towns and villages are situated at short intervals throughout its length, but only where strong *nodality* exists, have cities developed.

Vancouver and Portland lie at either end of the Basin where the N-S axis is crossed by E-W lines of traffic. Everett, Seattle, and Tacoma stand upon the intersections of the trans-Cascadian pass routes with the axial route. New Westminster and Vancouver, Washington, are river crossing towns. Kelso-Longview is located upon the first great bend of the Columbia where traffic from the north first touches navigable water. Bellingham in somewhat similar fashion lies at the inner bend of the Juan de Fuca-Georgia Strait waterway and in addition is the first point from which northbound traffic may cut across to ascend the Fraser Valley. In the south, Olympia stands at the extreme southern end of Puget Sound where southbound traffic cuts across to the Columbia Valley. Centralia-Chehalis lies upon the intersection of the N-S axial route with the E-W line of traffic which ascends the Chehalis Valley from Grays Harbor.

All the cities of the Puget Basin except one, therefore, lie upon the region's

main axial route or on the approaches to it. The exception is Bremerton which is situated on the western shore of Puget Sound. Its importance, however, is due to artificial stimulation by shipyards and a naval repair station.

THE FOCAL CITY

In the geometric center of the Basin is Seattle. There are manifold disadvantages for city growth in the site of Seattle, but its locus possesses many inherent virtues, notably that of focality. (The morphology of a city results from a compromise between the character of its local site and the nature of its functional activities. In contrast to this, the specific situation of a city is the result of locus or relative location.) This city stands midway between the two great river valleys which enter the northern and southern ends of the Basin. It is the western terminus for Snoqualmie Pass which is by far the best of the passes through the Cascade Mountains. Moreover, it is so situated that traffic through all three of the trans-Cascadian passes comes to a focus at its port.

During commercially normal times, Seattle tends to grow very rapidly. Due to both its isthmian position and its central location upon the axial route, Seattle shows a marked tendency to expand by N-S attenuation. Already there exists an almost continuous line of suburban and highway-hamlet development southward to Tacoma and northward to Everett. This suggests that there is here an incipient City of Puget Sound whose attenuated main street will ultimately occupy some 70 miles or more of the N-S axial highway.

Although Seattle is now the commercial metropolis of the Basin, this need not necessarily remain the case. Several projects and possible developments may alter the present ratio of locational values. One of these is the proposed Puget Sound-Grays Harbor Canal. This waterway when constructed will unquestionably modify the existing relative importance of Seattle, Tacoma, Olympia, and the City of Grays Harbor. The opening of Cascade Pass between Lake Chelan and the Skagit Valley, or some equivalent northern route across the Cascade Mountains, might in similar manner have a bearing upon the relative importance of Everett, Bellingham, and Vancouver.

ALTERNATIVE DEVELOPMENTS

There is under way a giant reclamation project in the Columbia Basin. Whether this will contribute ultimately to the growth of Portland or Seattle is problematical. The proposal to canalize the Columbia River promises to bestow this immense hinterland upon Portland. To offset this, Seattle, aided by Tacoma, seeks to develop a low gradient all-weather route across the Cascades and to secure discriminatory rail rates from the interior.

Lastly, it must be remembered that Portland draws in part its sustenance from the Willamette Lowland as well as from the Puget Basin. A disproportionately large development of the former region would result in added competitive strength for Portland. At all events, the most relentless commercial struggle of the next century in America will be waged between these two growing ports of the Northwest. The odds will attach in part to that city whose geographical location is superior, and in part to that city which can adjust itself most successfully to the extra-regional aspects of that location.

HUEPAC: AN AGRICULTURAL VILLAGE OF SONORA, MEXICO*

Leslie Hewes

HUEPAC is located in north central Sonora on the Sonora River (Figure 1). Hermosillo, the capital of the state, lies to the southwest; Cananea, a copper-mining town, to the north; and Nacozari, another copper center, to the northeast. All three are approximately one hundred miles by road from Huepac. Hermosillo is a stop on the Sud-Pacifico de Mexico, and Cananea and Nacozari are railhead towns. Huepac is on no railway and has only the road, the old camino real. By the site of Huepac passed explorer, conqueror, and missionary. Huepac, itself, was a Jesuit mission foundation. Now the occasional passage of an automobile gives only limited contact with the outside world, and Huepac remains a rather remote agricultural village, depending chiefly upon its own fields and grazing lands.

Site

The basic pattern of the general area is that of roughly parallel north-south valleys and ranges of the Basin and Range Province. Streams have begun the evacuation of the basin fill, leaving gravelly terraces above the alluvium of the flood plains. Back of the terraces, at some distance, rise short, disconnected, barren mountain ranges (Figure 2).

The terrace on which Huepac is situated rises abruptly some fifty feet above the flood plain of the Sonora River, which here has an altitude of nearly 2,000 feet. Normally the river shifts about on a bed of sand and gravel, about one-fourth mile wide on the average, between low cut banks, but occasionally floods cover most of the flood plain. Floods in summer are frequent; those of winter are less frequent but more severe. In December, 1914, and again in September, 1926, floods, due to heavy rains in the headwaters, washed away crops, livestock, fences, and fertile agricultural land, and deposited much sand and gravel on fields once valuable. A copy of an old map, in possession of the local government, indicates that before these floods to the south of Huepac there was as much agricultural land west of the river as east of it. Now there is very little agricultural land to the west of the river (Figure 3).

The dominant vegetation of the area is a low *monte*, composed principally of scattered, thorny, leguminous bushes with small leaves. The *cholla* (*opuntia fulgida*) and *palo verde* (*cercidium torreyanum*), desert indicators, are present. The *palo blanco* (*ipomea arborescens*), a steppe indicator in Sonora, is absent. Grass is scanty.

On the basis of the vegetation the climate is classed as desert, a tame desert in the terminology of Sir Aurel Stein. The rainfall régime resembles that of southern Arizona. Some rain occurs both in summer and winter, convectional in summer, cyclonic in winter. Summers are hot but frosts occur as early as November and infrequently as late as April, but are rarely severe enough to form ice in the irrigation ditches.

* Field work was done during the autumn of 1931 when the writer was with Dr. Carl Sauer as Field Assistant from the University of California. The statistics cited are based on the map made in the field and on original sheets of the census of May 15, 1930, and are far below the published figures. The Huepac area is considered representative of north central Sonora, Mexico.

Some snow falls on the nearby mountains.

SETTLEMENTS

The Municipio of Huepac had, according to the census of 1930, 1,136 inhabitants. The concentration of population in agricultural villages is pronounced, but the few families living on the land evidently have been included in the figures for the villages. Local census records give the following popu-

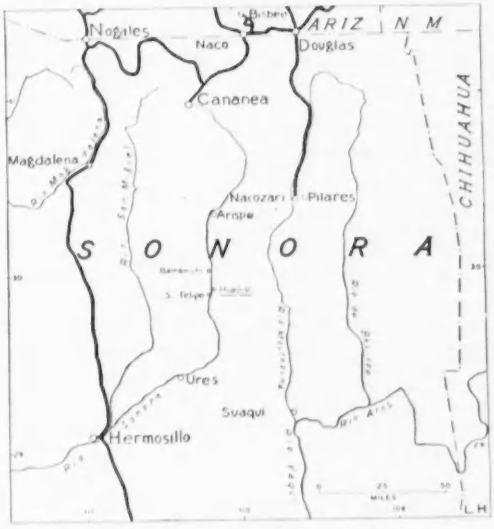


FIGURE 1.—Location of Huepac, Sonora.

lation figures: Huepac, 761; Ranchito de Huepac, 271; and El Ojo de Agua, 56: eight *ranchos* totaling 48; total population of the *municipio* 1,136. In November, 1931 the population of the villages had been considerably increased by the return of laborers from the copper mines of Sonora and from the United States.

The inhabitants are Mexicans, i. e., mestizos with varying amounts of Indian blood. There are no pure blood Indians left in the *municipio* but many appear to have a large percentage of Indian blood.

The Pueblo of Huepac is the largest village in the *municipio*. It occupies a terrace overlooking the agricultural bottom lands, as is commonly true of the pueblos in the *Valle de Sonora*. Freedom from floods, ease of defense, easy riddance of waste are advantages enjoyed by the modern pueblos, as by the ancient Indian settlements. The general flatness of the terrace has made possible a quite regular street pattern (Figure 4). The streets are unpaved. Houses, flat-roofed, usually one story, of adobe, and windowless, present nearly continuous wall-like fronts directly on the streets. There are no front yards or lawns and but small stretches of sidewalk. Corral enclosures of adobe help to wall in the streets. In the outskirts, however, a wider spacing of houses and use of wire or brush fences for corrals give a more open aspect. There are few trees to enliven the prevailing earthy drabness.

Near the center of the pueblo is the plain, unadorned plaza. About it lie some of the better houses. Here, too, is the old Jesuit mission church, decadent, but still in use, and the local government building (*ayuntamiento*).

Except for the tendency of the better houses to be located near the plaza and the more open buildings in the outskirts, there is no zonation. There is no commercial core as there are only two small stores, in which the owners live, and these are located three blocks apart. In addition to the church, the government building, and two stores, there is a post office, school, blacksmith shop, tannery, and a flour mill in Huepac. Of the buildings serving other purposes than dwellings only the church and the flour mill can be distinguished from the dwellings.

The houses of the village differ only in degree, not in kind. With the exception of one house of brick, all are of adobe. One story adobe houses, unplastered, varying in size, excellence, and

degree of repair, are most numerous. Some are little better than occupied ruins. Roofs of brush and dirt are characteristic. One hundred and sixty-six unplastered adobe houses were counted. In addition, there are twenty-six houses with plastered walls, light in color, a few with two stories. Half of these more pretentious houses are falling into disrepair.

Numerous ruined houses, sixty-nine, or over one-third as many as are capable of habitation, suggest a former period of greater prosperity. The Revolution is blamed for the decline. Some fourteen foreigners, some with families, engaged in the mining business, lived in Huepac prior to 1910, it is said. These and a number of well-to-do Mexicans have left the country. Also the Revolution caused the loss of a considerable number of lives in the area. The repairing of new and ruined houses in the outskirts suggests that new houses have replaced the old ones there.

There are about twenty-five auxiliary buildings, serving as kitchens, storage places, animal shelters, and three or four garages. They are small and poorly built, perhaps open at the side.

A surprisingly large number of animals are kept in the village of Huepac. Cattle are most numerous but there are horses, mules, donkeys, and chickens, also. Many of the corrals occupy entire back yards (Figure 5) and are enclosed by adobe walls, barbed wire, or brush fences. Brush fences are found in the outer, poorer sections of the pueblo. A few sheds and some of the ruined houses serve as shelters, but in most cases there is no semblance of a shelter for the animals. The map of the pueblo (Figure 4) shows how large a part of the village area is used for corrals.

FIGURE 2.—Sonora Valley landscape. Mountain and filled basin (fill now partially removed by the Sonora River) of the Basin and Range Province. "Monte" vegetation.

The pueblo contains very few gardens or orchards. There are only three small huertas containing citrus fruit trees and flowers. Huepac is probably near the limit of citrus fruit, for many Sonoran villages in areas less subject to frosts have orange, lemon, limón, and grapefruit trees in some number.

The Ranchito de Huepac, a smaller village, a *comisaría* of Huepac, has a population somewhat less than half that of Huepac, but has about the same appearance. It lies, however, not on the terrace, but at the base, with its fields on three sides.

El Ojo de Agua, a *congregación*, is

an old settlement, almost deserted until recent years. Now, however, a growing number of *agraristas* are moving from Huepac to El Ojo de Agua in order to be near their fields, which lie to the north of the latter place. (See section on land tenure.) As yet this growing village is no more than a loose grouping of houses along or near the camino real, occupying a slightly elevated extension of the terrace behind. The houses are of adobe and of brush and reeds. The largest building is an adobe school house which is being built with money collected from the *agraristas* of Huepac and El Ojo de Agua. There are few *agraristas* in Sonora.

Some twenty families live in their fields (*milpas*) or along the camino real. Beside the houses permanently occupied, there are others in some of the fields smaller and ruder in construction, of brush, and corn stalks (Figure 6). These *casitas* or *jacales* are occupied temporarily during the seasons of planting and harvesting.

The total non-village population, including those living in milpas and along the camino real and on the several ranchos of the *municipio* is only about 150.

LAND TENURE

The *ejidos* of Huepac occupy most of the *municipio*. These are, for our purposes, village lands as they are not enclosed and hence serve as public pasture and the source for fences, fuel, and building material.

Along the river, on both sides, are the fields (*milpas* of the *municipio*, mostly small, and with the exception of the fields of the *agraristas*, all are privately owned. Incomplete local census records indicate that the average property contains about fifteen acres. These lands have been worked for a very long time. Some of the best land is still known as the lands of the mission (*Tierras de la Misión*).

The lands of the *agraristas* total about

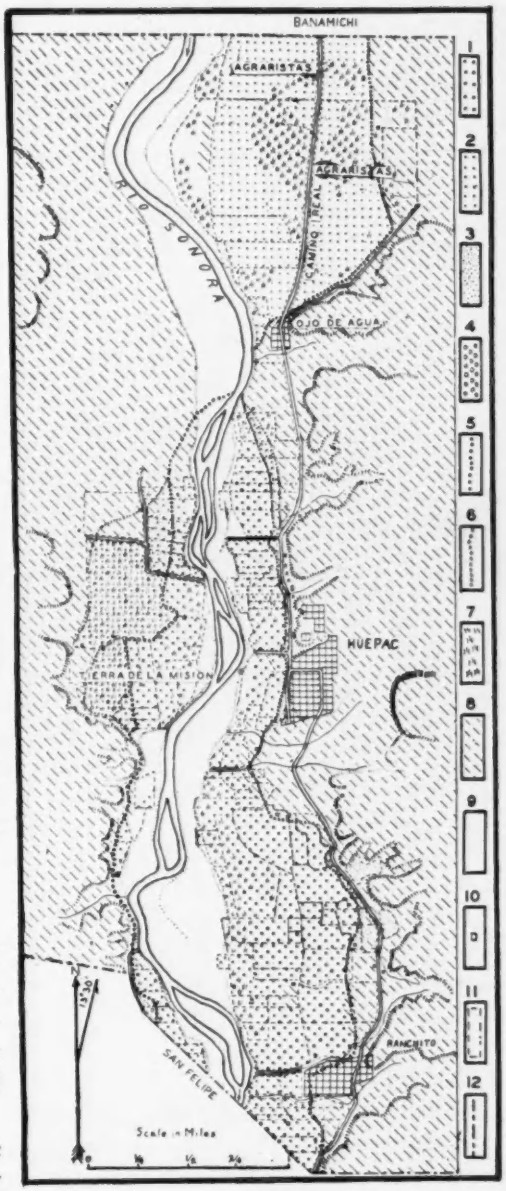


FIGURE 3.—Land Utilization in the *Municipio* of Huepac, Sonora. Legend:

1. Riego
2. Semi-Riego
3. Temporal
4. Former Riego
5. Limiting Acequia
6. Abandoned Acequia
7. Grassy Tracts
8. Monte
9. River brush
10. Farm house
11. Enclosure
12. *Municipio* Limit

Areas 1, 2, and 3 compose the crop land, and the areas 7, 8, and 9 chiefly pasture land.

378 acres, including a small amount of pasture. These lands were taken by the government for the use of landless families of Huepac and El Ojo de Agua. Each *agrarista* has the use of three hectares (7.4 acres) of land, for which he must give two sacos (1.72 bu.) of corn and two fanegas (5.17 bu.) of wheat each year for the expenses of *agrarismo*, including the upkeep of fences and irrigation ditches. Now a school in El Ojo de Agua is being built by the *agraristas*. The *agraristas* are not the only landless of Huepac as incomplete local census figures indicate that over one-third of the properties are worked by renters.

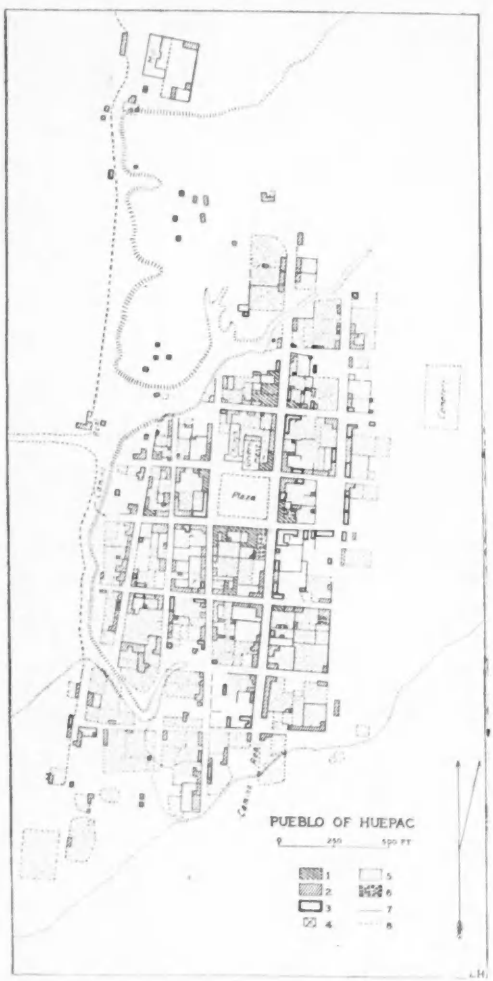


FIGURE 4.—Pueblo of Huepac. Legend:

1. Better class houses. Plastered adobe houses kept in repair.
2. Other houses—unplastered adobe and some formerly of first class now falling into disrepair.
3. Ruined houses.
4. Auxiliary buildings, including animal shelters, storage, kitchens, and garages.
5. Corrals.
6. Huertas, chiefly orange trees.
7. Adobe walls.
8. Fences of wire or brush.

There are, in addition, a number of privately owned *ranchos*, most of which are at some distance from the pueblo. These are principally cattle ranches.

IRRIGATION AND TEMPORAL

An individual owning property along the river may dig an irrigation ditch (*acequia*) as he sees fit; but most ditches serve a number of properties, and their use is regulated by commissioners. By the use of pumps or permanent dams a larger area might be irrigated and a more uniform flow of water be maintained, but at increased cost. According to the *presidente municipal*, the cost of irrigation, including cleaning of the ditch and higher taxes, for a five hectare property would be about thirty-one and one-half pesos per year. At the normal rate of exchange (par) this is about one dollar and forty cents per acre.

If local information is to be relied upon the amount of water available for irrigation is less than formerly. This explanation is given for the abandonment of some formerly irrigated land.

It is interesting to note that during the dry months of autumn and spring the Rio Sonora frequently is dry to the north of El Ojo de Agua, whereas southward, due to welling up of water from below, there is always water in the river and water in the ditches, although some of the outer lands may suffer from water scarcity. Furthermore, the land to the north of El Ojo de Agua suffers from the fact that it lies at the end of an irrigation system that includes part of the lands of Banámichi. In some years no

FIGURE 5.—A back-yard in Huepac. The use of the back-yard as a corral is characteristic as is the drying of chile and tobacco on the back wall of the house.

water reaches these fields. These lands are accordingly classified as *semi-riego* in contrast to the lands of dependable irrigation or pure *riego*. The lands of the *agraristas* are included in the *semi-riego*.

Although irrigation is essential to insure a crop, some farming is done without. Lands dependent on the rainfall only are known as *temporales*. The *temporales* for the most part adjoin the *riego* lands on their upper margins, above the outer irrigation ditches. Several small *temporales* occupy *cañada* mouths where the soil is sandy rather than gravelly and no well developed water courses exist. Some of the *temporales* have only recently been cleared. Since the destruction of much valuable land along the river by floods, some higher, drier lands have been cleared for cultivation. There are also a few small *temporales* in distant *cañadas* to the west.

CROPS AND FIELDS

Wheat, corn, beans, chile, sugar cane, and tobacco, arranged approximately in order of acreage are the most important crops. Wheat, introduced by the Jesuit mission fathers, may owe its present importance to early mission activity. Since the expulsion of the few Chinese renters in the autumn of 1931, *calabazas* (chiefly squash) and watermelons are the only vegetables produced, other than a few onions and sweet potatoes. Huepac is unlike many Sonora villages in having few citrus fruit trees.

Double cropping of wheat and corn is common. Wheat, the most important crop, is planted from October to January, grows during the cool winter, and is harvested about June, during rainless, warming weather. During the winter months there is sufficient water in most of the irrigation ditches, but some of the *temporales* depending only upon the light winter rainfall occasionally produce good crops. Corn, which follows wheat on much of the land, is planted after wheat harvest in time to take advantage of the light rain and heat of summer. Corn, in turn, is harvested during the dry, cooling months of late autumn in time to permit the planting of wheat on the same ground. Corn is more commonly grown without irrigation than is wheat.

Beans, quick growing and requiring little moisture, are most commonly grown during the dry spring and may be removed in time for corn to follow.

Chile, sugar cane, and tobacco, because of their long growing season, cannot follow wheat in a double cropping

system. They are planted in February or March and harvested in November or early December. Although winter freezes are not severe enough to kill the cane it is ordinarily planted yearly because of the better yields obtained. Huepac is near the northern limit of cane cultivation in the valley.

Wheat and corn are grown in all portions of the agricultural lands of the *municipio*, although yields vary greatly. In the *semi-riego*, lands of undependable irrigation, north of El Ojo de Agua and in the *temporales* corn and wheat, with a few spring beans, are the only crops. The concentrated, though light, summer rains make corn the most important crop raised without irrigation.

FIGURE 6.—An *agrarista* in the field he works. On the left is a rude house that is occupied only during seasons requiring much work in the fields.

Chile, cane, and tobacco are grown only in the pure *riego*. Certainty of water supply seems more necessary than good soil, for even sandy land in riverside fields may be planted to these crops while higher silts and loams are rarely used.

Crops other than wheat, corn, and beans rarely if ever occupy an entire field, but are found interspersed in small, irregular patches among corn and other crops. An attempted self-sufficiency in the holdings has resulted in this patchwork.

Only some twenty families live on the land. As the villages are close to most of the fields, many of the villagers are content to go there to work and return to the village at night. During the rush seasons of planting and harvesting some occupy rude houses or shelters (*casitas* or *jacales*) in the fields (Figure 6) instead of returning to the villages. This is the custom of a number of the *agraristas* who live in Huepac. Other *agraristas* have moved to El Ojo de Agua in order to be near their fields.

Much hand labor is required in the fields. The walking plow is the only common piece of farm machinery. In spite of the small size of most of the holdings it is necessary to hire labor at harvest and other times. Donkeys are much more commonly used than wagons in bringing in the harvest.

Little effort is made to keep up the fertility of the soil in spite of the heavy drain made on the land by frequent double cropping. Pasturing of animals on the fields after harvest compensates in part for lack of artificial fertilization and crop rotation. Some fallowing is done.

The yields are distinctly low for irrigation agriculture. Wheat probably averages between 26 bushels per acre, the estimate for *riego* made by the *presidente municipal*, and 11.37 bushels,

the average of the census data for a poor year. Corn probably averages between 15.5 bushels per acre, estimate of the *presidente municipal*, and 12.65 bushels, the average of the census data for a subnormal year.

SLENDER AGRICULTURAL BASE

The amount of crop land in the *municipio* is small. Excluding only a few small outlying *temporales*, the total acreage of crop land is 1,355 or about one acre per capita. *Riego*, land of dependable irrigation, totals 769 acres; *semi-riego*, land of undependable irrigation, totals 517 acres; and *temporal*, crop land without irrigation, 69 acres. (Figures are based on computations made from the field map (Figure 3).)

Deposition of gravel and sand by floods has caused the abandonment of crop land, notably to the north of El Ojo de Agua and across the river from Huepac. A large tract of land opposite Huepac, undamaged by floods has been abandoned due to decreased supply of water for irrigation. Along the river between Huepac and Ranchito much of the abandoned river bed, now enclosed, is too sandy for crops. Grassy tracts, infrequently cultivated or abandoned, total 596 acres.

Although Huepac probably has suffered more from flood damage than the average Sonora village, it is typical of the average in its slender agricultural base.

In spite of the limited amount of crop land and the low yields the *municipio* is practically self-sufficient in agriculture and has small surpluses at times. Self-sufficiency is made possible by the practice of double cropping much of the land, thus increasing its productivity, by the fact that domestic animals consume only a small share of the crops, and by the low standard of living.

STOCK RAISING

Grazing is the only use made of most of the land in the *municipio*. The dry *monte*, with but little grass, makes poor pasture. Wells, *arroyos*, and dams furnish water for the animals, but on some *ranchos* water is scarce, particularly so in the spring months. In some years animals die from poor pasturage and lack of water.

According to the *presidente municipal*, there are some twenty *ranchos* in the *municipio*. On the *ranchos*, cattle, of nondescript type, are most numerous. The quality is being improved by the use of some Hereford and Shorthorn bulls.

Livestock are not confined to the *ranchos*. They are found in the villages and on the agricultural properties in surprisingly large numbers. A great majority of the families in Huepac keep livestock, chiefly cattle. Sixteen small agricultural holdings, for which there are local census figures available, containing a total of about 302.5 acres, had in 1930 a total of 345 cattle, 166 horses, 42 asses, and 22 mules. The animals of the village and of the agricultural holdings spend most of the time on the unenclosed *monte* and river brush of the village land (*ejidos*). Animals belonging to the occupants of the enclosed fields graze on the idle land and after the harvest are put on the producing fields.

The horses, asses, and mules are used for draft. The cattle provide milk, cheese, and meat for local consumption, and for shipment, principally to Cananea and Nacozari. Cattle are normally the most valuable export of the *municipio*.

SIGNIFICANCE OF MINING

Prior to the Revolution the Huepac area had some importance in mining. Some fourteen foreigners, in the mining business, some with families, lived in Huepac. With the Revolution they left. The most important mine in the

municipio, the Washington mine which produced copper and other metals, was closed in 1917. Since then there has been no mining.

The mines of Cananea and of Nacozari furnished ready markets for pastoral and agricultural products from the *Valle de Sonora* pueblos, including Huepac, until the low price for copper forced a shut-down a few years ago. Now those markets are closed. The laborers from the mines have drifted home, swelling the village populations.

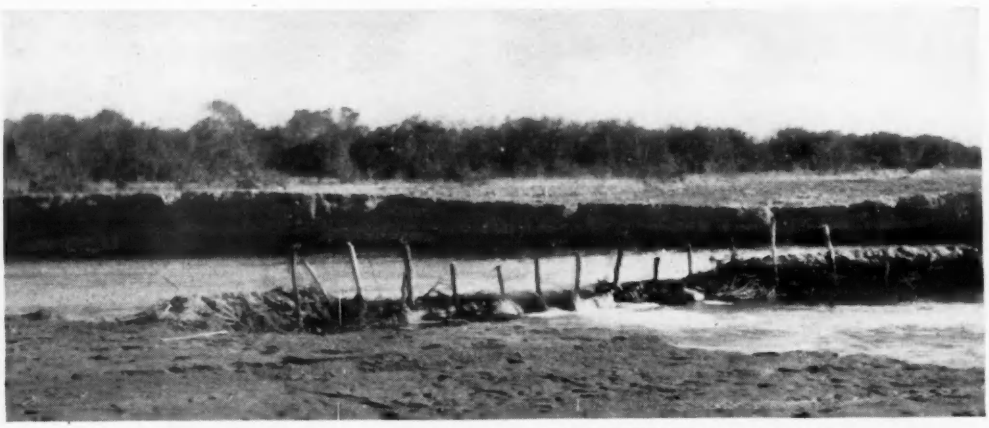


FIGURE 7.—Temporary dam of brush and dirt at head of irrigation ditch.

ECONOMY

Huepac is primarily an agricultural village. Most of those who live in it depend directly on the soil for their support either as owners, renters, laborers, or *agraristas* whom the government permits the use of land.

The pueblo is largely self-sufficient. Most of the food is produced and prepared in the area. Wheat from the local fields is ground in the flour mill. *Penoche*, a candy-like cake of brown sugar, is prepared from the juice pressed from cane by means of animal power in several small countryside mills. Corn, beans, chile (Figure 5) *calabazas*, and watermelons are prepared at home. Meat, milk, cheese, chickens, and eggs are local products. Wild fruits, such as the *pitahaya* and *tuna*, are gathered. In central Sonora the wheat *tortilla* replaces corn as the principal food. Beans, cheese, and dried meat are common fare, also.

Tobacco is home grown and prepared at home. Adobe bricks, hides, tanned in the local tannery, and frequently made into homemade shoes, brush for fences, firewood, and building material are local products.

Clothing, a minimum of house furnishings, petroleum products for the few auto trucks and gasoline pumps, and a few potatoes, produced at Cananea by Chinese are among the products brought in from the outside.

In return, cattle are driven to the mining towns of Cananea and Nacozari, and cheese, dry meat, and small agricultural surpluses are normally trucked there. Since the shutdown of the mines Hermosillo is the chief, though small, market for agricultural produce.

The closing of its most important markets and the return of a considerable number of miners have destroyed Huepac's prosperity, but no great hardships have resulted, for Huepac is primarily a self-sufficient village, furnishing most of its own simple requirements.

DISTRIBUTION OF DEERFIELD RIVER POWER

A. K. Botts

INDUSTRIAL activity is, directly and indirectly, the major factor determining the consumption of electrical energy in any region. A high degree of industrial activity influences consumption directly by utilizing electricity as a motive power in industrial processes. Indirectly, it affects consumption by causing large population concentrations that use electricity extensively for domestic, municipal, and transportation purposes.

Although northwestern Massachusetts and southern Vermont possess extensive, well-developed hydroelectric resources, the region consumes little power. Deerfield valley possesses neither extensive industrial development nor large population centers. Therefore it must go beyond its own limits to seek markets for its leading commodity, hydroelectric power.

Distribution of Market Areas

The accompanying map (Figure 1), by showing the distribution of wage earners in manufactures in principal cities, indicates clearly the chief market areas for New England electricity. The Deerfield River region, shaded, contains no large consuming center. The nearest market cities are North Adams, Northampton, and Pittsfield. The two largest cities in the valley are Greenfield, population 15,500, and Shelburne Falls, population 2,500.

Estimates, based on statistics published by Western Massachusetts Companies, indicate an average annual production of power in Deerfield Valley of 460,000,000 kw. hr. of which not more than 20,000,000 kw. hr. are consumed locally. Thus fully 95% of the product is available for export.

Holding Company Territories

Figure 2, showing the territories served with electricity at retail by various holding companies in 1930 and 1919, indicates that the two companies controlling the output of Deerfield Valley serve principally western and central Massachusetts and Rhode Island. It must not be thought, however, that the market for Deerfield power is limited to the areas thus designated or that the two areas specified are mutually exclusive. There is a great deal of interchange among all the companies with the result that power generated in a Deerfield plant may be sold in any part of southern New England.

Deerfield Valley as an Electricity Consumer

Fully one-third of the Deerfield region is without electric service (Figure 2); of the remainder more than half is supplied by Western Massachusetts Companies. The rest is divided among several independent companies and one municipal distributor.

The major consuming area, the most densely populated part of the valley, is served by Western Massachusetts Companies. That association owes its market domination in this region to the early activities of the Greenfield Electric Light and Power Company. The first hydroelectric development on Deerfield River was undertaken in 1904 by the Greenfield Company. After absorbing all of the market in the town of Greenfield the company extended its market area by expanding into the neighboring territories to the west of Greenfield until it controlled most of the towns and villages of the lower Deerfield Valley. When the

Greenfield Power and Light Company associated itself with the Turners Falls Company and later, through that concern, with Western Massachusetts Companies, her market territory became the heritage of the larger organizations. Most of the electricity consumed in this market territory is supplied by the Gardners Falls plant located on Deerfield River a short distance down stream from Shelburne Falls, Massachusetts; but at times of particularly low water, current is imported from other parts of the Western Massachusetts System.

The other company, The New England Power Association, with its seven plants on Deerfield River produces almost exclusively for export. Excepting the limited domestic and small industry demands of the upper part of the valley, the chief market for "New England power" within the valley is at Hoosac Tunnel. That tunnel, owned and operated by the Boston and Maine Railroad, is electrified. All of its current is generated at Number Five Station, the lowest unit in the upstream group of plants (see ECONOMIC GEOGRAPHY, Vol. 11, No. 1, January, 1935). That station has special facilities to meet the requirements of the Hoosac Tunnel market. Attached to each turbine shaft are two generators instead of one as is the common arrangement. One of each pair is a 25-cycle generator and the other a 60-cycle unit. The 25-cycle generators operate only when power is needed at Hoosac Tunnel. The 60-cycle generators produce power to enter the transmission lines of the system at times when no power is needed at Hoosac Tunnel.

FRANKLIN COUNTY AS A MARKET

Deerfield Valley occupies the western half of Franklin County, Massachusetts. That county, and Barnstable, are the only two counties in Massachusetts not represented by a single dot on the map of wage earners in Massachusetts (Figure 1). Although Franklin County contains some important manufacturing establishments and towns, its capacity to consume electricity is slight by comparison with its capacity to produce hydroelectricity.

WESTERN MASSACHUSETTS AS A MARKET

Western Massachusetts provides a much more flourishing market for electric energy than either Deerfield Valley or Franklin County. But, as a consequence of the distribution of holding company spheres of influence, much of the power generated in Deerfield Valley is excluded from the western Massachusetts market area. A comparison of Figures 1 and 2 indicates that the industrially important parts of western Massachusetts are served by Western Massachusetts Companies. Since the Gardners Falls plant is the only Deerfield development belonging to Western Massachusetts Companies, it is apparent that only a small portion of Deerfield power can depend on western Massachusetts industries for a regular market.

As a consequence of interchange, large blocks of Deerfield power are, on occasion, consumed in such places as Northampton, Holyoke, Chicopee, and Springfield, but these cities cannot rightly be considered an important part of the present market area for Deerfield power. However, if western Massachusetts continues to grow industrially during the next two decades, as some carefully made economic surveys indicate it may, the region will likely provide a market for a larger percentage of the power developed on Deerfield River.

NEW ENGLAND MARKETS

The market area for the New England Power Association includes practically all of central Massachusetts, much of

TABLE I

DEERFIELD VALLEY HYDROELECTRIC STATIONS

Name	*Location*	*Owned by*	*First Operated*	*Head in Feet*	*Capacity H.P.*	*Capacity Kw.*
Searsburg	Upstream	N.E.P.A.	1922	250	6,700	4,700
Harriman	Upstream	N.E.P.A.	1924	390	60,000	45,000
Sherman	Upstream	N.E.P.A.	1926	80	8,600	6,000
Number Five	Upstream	N.E.P.A.	1915	240	20,400	15,000
Number Four	Shelburne Falls	N.E.P.A.	1912	64	9,000	7,000
Number Three	Shelburne Falls	N.E.P.A.	1912	66	9,000	7,000
Gardners Falls	Shelburne Falls	W.M.C.C.	1904	37	5,300	4,000
Number Two	Shelburne Falls	N.E.P.A.	1912	60	9,000	7,000

eastern Massachusetts, most of Rhode Island, and a small section of Connecticut (Figure 2). These areas embrace several of the most important manufacturing sections of New England. The heart of the New England Power Association system—its dispatching headquarters—is located at Millbury, a few miles south of Worcester. The two main transmission outlets of Deerfield Valley lead straight to Millbury, the one from Harriman Station in southern Vermont, and the other from Number Five through the Shelburne Falls group of stations. From the dispatching station at Milbury the Deerfield power may be distributed to any locality within the market area of the New England Power Association.

Connecticut, as a whole, is well supplied with hydro- and steam-electric plants and imports electricity only to meet unusual load conditions or to take advantage of favorable price factors.

Northern New England as a present and potential market for power is unimportant. The possibility of Deerfield power entering that region is remote. That is particularly true of the state of Maine where the export of power is prohibited by law, and interconnections and interchange are consequently hampered.

It appears that the major market, both present and future, for Deerfield power lies in central Massachusetts. A minor market exists in Rhode Island and eastern New England, but in these areas competition with steam power is acute.

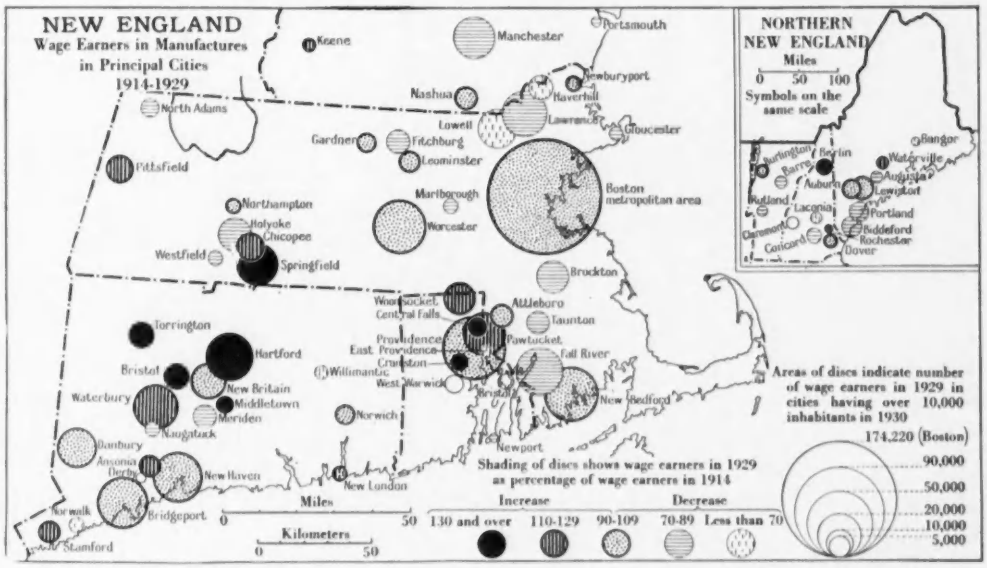


FIGURE 1.—Wage earners in manufactures in New England cities of over 10,000 inhabitants in 1930. The southern part of Deerfield River Valley is outlined in the northwestern part of Massachusetts. (Reproduced from "New England's Prospect: 1933," American Geographical Society Special Publication No. 16, New York.)

Because of the distance from Deerfield Valley, transmission loss is high. Consequently local seaboard plants, requiring only short distance transmission, offer keen competition to the distant hydroelectric plants (Figure 3). However, Deerfield power developments are provided with an adequate, well established, and growing market.

STRUCTURE OF THE POWER MARKET

As the market area for Deerfield power is quite typical of the entire southern New England industrial area, an understanding of the structure of that market can best be obtained by studying the nature of the general power situation in southern New England.

Table II shows the chief groups of consumers within the New England market.

TABLE II

CURRENT SOLD, TO ULTIMATE CONSUMERS ONLY, BY CLASS OF SERVICE, ALL ESTABLISHMENTS, NEW ENGLAND, 1927 AND 1932

	In Millions of Kw. Hr.		*Per Cent of Total*	
	1927	*1932*	*1927*	*1932*
Total sales	3,956	4,487		
Industrial sales	2,956	3,025	73.39	67.12
Wholesale	(2,176)	(2,340)	(54.73)	(52.00)
Retail	(737)	(685)	(18.66)	(15.12)
Domestic service	576	1,018	14.72	22.45
Municipal street lighting	150	186	3.96	4.16
Farm service	3.9	26.7	0.07	0.58
Street and interurban railways	176	?	4.53	5.69
Undistributed by class of service	124	?	3.33	?

The most assuring feature of this table is the consistent growth of the market through a period of general depression in industry. All but one of the items, where comparison is possible, show appreciable increases in consumption of electric energy. The total industrial sales show the least gain, and the retail industrial group (small light and power consumers), shows an actual decrease in consumption amounting to approximately 50,000,000 kw. hr. Although total industrial sales show a slight gain, the importance of that group relative to the total consumption has declined considerably. The largest increase in kilowatt hour consumption took place in the domestic service category which consumed 432,000,000 kw. hr. more in 1932 than in 1927.

The changes in the relative importance of these consuming groups is more clearly appreciated by a comparison of the percentage columns in Table II. Here we see that, compared with the total sales, industrial use of electricity has decreased from 73% to 67%. But losses in industrial consumption have been more than compensated by increasing consumption in the domestic service field. Farm service has made the most spectacular change, although its importance as an electricity consumer is still insignificant. Farm consumption increased more than sixfold during the six-year period under consideration.

TABLE III

DISTRIBUTION OF DIRECT SALES OF NEW ENGLAND POWER ASSOCIATION BY CLASS OF SERVICE, 1929 AND 1932

Percent of Total Direct Sales

	1929	*1932*
Total direct sales, millions of kw. hr.	980	1,016
Industrial sales	74.00%	66.70%
Domestic sales	10.30	18.20
Municipal service	3.55	4.14
Electric railways	10.70	3.66
Other direct sales	1.03	3.72
Used by company	.42	3.58

The ranks and trends of items in Table III showing distribution of direct sales of electricity by the New England Power Association exhibit a striking similarity to those of Table II. On the basis of these tables it appears that the distribution of market by class of consumer for New England Power Asso-

ciation, and thus for Deerfield power, is very much like the distribution of New England.

THE INDUSTRIAL MARKET WHOLESALE AND RETAIL

In statistical classifications the industrial consumers are subdivided into two groups: The wholesale consumer who purchases large blocks of electric energy for industrial purposes, and the retail consumer who buys power in small quantity for the same purpose. These customers comprise a high percentage of the manufacturing institutions of New England. Originally all of New England's industries of that class were run by water wheels. With the invention and improvement of steam engines the newer establishments adopted steam as a prime mover. Then, when electrically generated power was made available, another shift set in. Because electricity can be used so conveniently in small as well as in large units of power, most of the new and remodelled establishments are adopting electric motors as their prime movers. The following table summarizes the nature and extent of these changes:

Each of the three older types of prime movers declined considerably in rated capacity. That decline was offset by an increase in the number of motors operated on purchased power. These motors are the prime movers using much of the power sold to the wholesale and retail industrial consumers.

In addition to increased capacity of motors operated by purchased power there has likewise been an increase in the rated capacity of motors operated by owned power. Such power is generated by the manufacturing institution using it, and although it does not directly affect the general electric market it does represent growth in the use of electricity. Between 1923 and 1929 the rated capacity of such motors increased 21%.

DOMESTIC AND RURAL SERVICE

There are three ways in which the domestic use of electricity can be expanded. The companies can extend the service into new territories with the construction of new distribution lines. They can add new customers to existing lines. Or they can encourage wider use of electricity within the home. Of the three, the first two require the greatest investment by the company involved. However, the importance of those two methods of increasing the sale of electricity is suggested in the accomplishments of New England's largest power company between the years 1927 and 1933. In the latter year they served 409,620 domestic customers, whereas in 1927 their total in that class of service was 131,417.

The most effective way to achieve a greater consumption of electricity within the home or on the farm is by the introduction of new electrical appliances. Every time a householder installs a new radio, electric range, washing machine, milking machine, motor, or minor appliance he automatically creates a de-

TABLE IV

TYPES OF PRIME MOVERS USED IN NEW ENGLAND INDUSTRY, 1923 AND 1929

	1923		*1929*	
	Rated Capacity H.P.	*% of Total H.P. Used in Mfg.*	*Rated Capacity H.P.*	*% of Total H.P. Used in Mfg.*
Steam engines and turbines	1,778,000	42.80	1,680,000	36.50
Internal combustion engines	46,000	1.13	35,000	.75
Water wheels	761,000	18.33	742,000	15.50
Motors operated by purchased power	1,565,000	37.14	2,228,000	47.25
	4,150,000		4,685,000	

mand for more electricity. The importance of increasing consumption per customer is illustrated by the following table:

TABLE V

DOMESTIC ENERGY USE OF THE WORCESTER ELECTRIC LIGHT COMPANY

Kw. Hr. Sales Per Customer Per Year Compared with the Same Items for New England and the United States

Year	*Worcester Electric Light Company*	*Average for New England*	*Average for United States*
1925....	302	330	447
1926....	316	335	452
1927....	326	371	473
1928....	373	422	507
1929....	405	468	547

Much effort has been expended in recent years in extending electrical service into rural areas. In fact that type of service has exhibited the greatest growth of any in recent summaries. In spite of phenomenal growth, rural customers remain one of New England's least important consumers in point volume.

MUNICIPAL STREET LIGHTING

Municipal street lighting has, from the start of electrical development, been

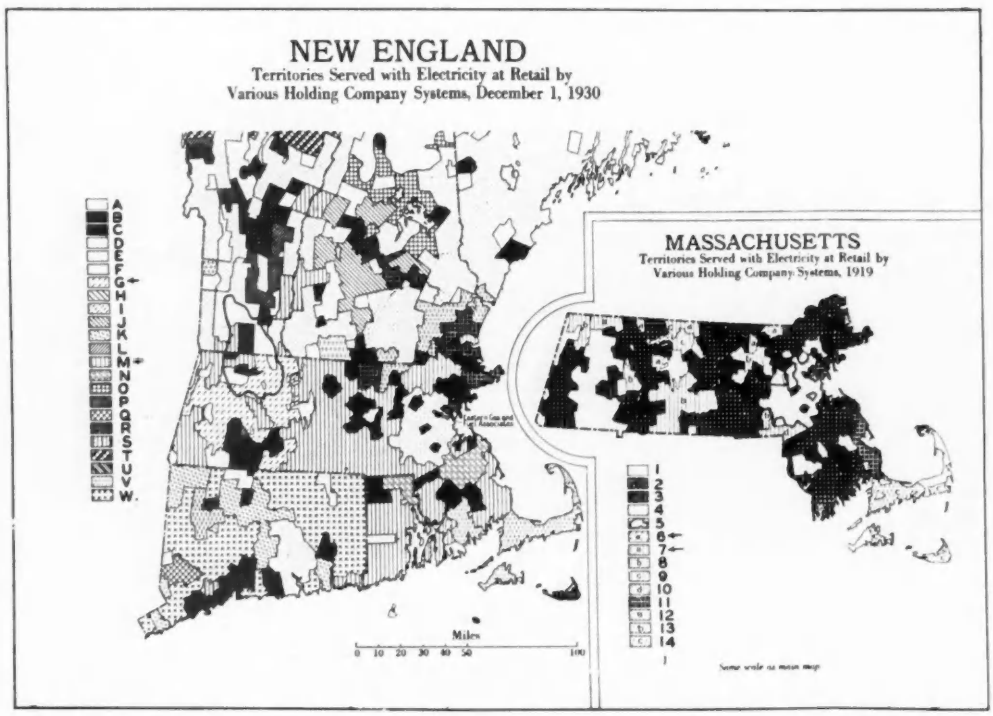

NEW ENGLAND
Territories Served with Electricity at Retail by
Various Holding Company Systems, December 1, 1930
A B C D E F G H I J K L M N O P Q R S T U V W
MASSACHUSETTS
Territories Served with Electricity at Retail by
Various Holding Company Systems, 1919
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Miles
0 10 20 30 40 50 100

FIGURE 2.—New England territories served with electricity at retail by various holding company systems, December 1, 1930 and 1919. Deerfield River Valley is outlined on the 1930 map. The two companies securing some of their power from Deerfield River are indicated with arrows.

Key: A. and 1. Towns with no electric service; B. and 2. Towns served by independent companies; C. and 3. Towns served by municipal concerns; D. and 4. Towns served by Boston Edison Company; E. Middle West Utilities; F. New England Water, Light, and Power Associates; G. Western Massachusetts Companies; H. Central Public Service; I. Public Utilities Consolidated Corporation; J. Hydro-Electric Development Syndicate; K. Connecticut Power Company; L. Eastern States Public Service Corporation; M. New England Power Association; N. Eastern Utilities Associates; O. Electric Utilities of the White Mountains; P. Colonial Utilities; Q. Cities Service Company; R. Tenney Properties; S. Utilities Power and Light Corporation; T. Tri-Utilities Corporation; U. Eastern Gas and Fuel Associates; V. Associated Gas and Electric System; W. United Gas and Improvement Company; 5. Boston Edison, 1909; 6. Turners Falls Power and Electric Company; 7. New England Power Association; 8. Massachusetts Lighting Companies; 9. Commonwealth Gas and Electric Companies; 10. Central Massachusetts Light and Power Companies; 11. Northern Boston Lighting Properties; 12. Central Electric Trustees of Massachusetts; 13. Cambridge Electric Securities Company; 14. Boston Electric Associates. (Reproduced from "New England's Prospect: 1933," American Geographical Society Special Publication No. 16, New York.)

an important direct or indirect function of electric companies. The first major order supplied by the Greenfield Electric Light and Power Company was an order to light the streets of Greenfield. That company gradually expanded into the surrounding villages and towns by first securing street lighting contracts and then developing the other branches of service.

In similar manner but on a much larger scale this street lighting history has been reënacted throughout New England, usually promoted by private electricity producers as was the case at Greenfield, but, in a few cases, promoted by the municipalities themselves. To New England power producers today, municipal service represents less than 5% of the electricity sold. In spite of declining relative importance, municipal street lighting service continues to grow in actual volume of sales. In 1927 the average New England municipality consumed 121.9 million kw. hr. of electricity. The average Massachusetts municipality, because of greater average size, used 281 million. The total revenue accruing to power companies from municipal service in New England amounted in 1927 to $8,338,000, of which Massachusetts towns and cities paid $4,933,000.

By far the greatest amount of municipally consumed electricity in New England is produced commercially. Even in some cases where the municipality owns its own distribution and service system it purchases electricity in bulk from a commercial concern. Of New England's total generated output of electricity in 1927, statistics indicate that only 1.9% was generated in municipal plants.

STREET AND INTERURBAN RAILWAYS

The type of service is another source of revenue for electric power companies. Although the future stability of the market is threatened by widespread use of gasoline buses, its present position among the group of consumers is prominent. The average New England customer in this class consumes electric energy in larger blocks than any other class of user. In 1927 hypothetical average street and interurban railway in New England consumed 3,403,389 kw. hr. of electric energy. The closest competitor, municipal street lighting, consumed 121,949 kw. hr. per average consumer.

UNDISTRIBUTED CLASS OF SERVICE

This designation represents power reported as sold by various producers who for different reasons did not indicate the class of market into which the energy entered.

PRIME MOVERS SUPPLYING NEW ENGLAND POWER

In industry that device which produces the primary power is referred to as the prime mover. This device, be it water turbine, steam engine, steam turbine, or internal combustion engine, may deliver its power directly to the machines or it may run an electric generator. Electric generators may be operated by any of the four types of prime movers, but by far the largest number are motivated by steam turbines and hydro turbines (Figure 3).

According to the United States census statistics of manufacture for 1932 the number of power producing establishments in New England has decreased in recent years. However, with one exception, the rated capacity of prime movers has shown considerable gain. The one prime mover reporting decreased capacity is the steam engine, but its total loss is more than made up by the increased capacity of the more efficient steam turbine. The internal combustion engine has experienced the greatest percentage increase, but its total

rated capacity is still of slight importance to industry in general.

The competition for the power market of New England is a competition between steam turbines and hydro turbines, a competition between coal and water.

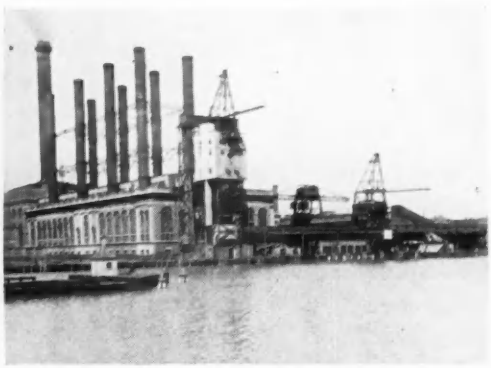


FIGURE 3.—The Narragansett Electric Lighting Company's plant in Providence, Rhode Island, is a unit of New England Power Association System. Tide water location makes the securing and handling of fuel relatively cheap and easy, thus providing abundant, economical power to complement and compete with the hydro-electric power produced inland. (Courtesy of the New England Power Association.)

TABLE VI

COMPARISON OF RATED CAPACITY WITH CURRENT GENERATED, FUEL BURNING AND HYDROELECTRIC EQUIPMENT, ALL ELECTRICAL ESTABLISHMENTS, NEW ENGLAND AND MASSACHUSETTS, 1933

	New England	*Massachusetts*
Rated Capacity		
Fuel, % of total	74.9	90.1
Hydro, % of total	25.1	9.9
Current Generated		
Fuel, % of total	56.3	78.0
Hydro, % of total	43.7	22.0
Anomaly	18.6	12.1

Table VI indicates that in New England electrical establishments, fuel equipment, with 74.9% of the total rated capacity, produced only 56.5% of the current generated in 1933. The hydroelectric equipment possessing only 25.1% of the rated capacity generated 43.7% of the electricity produced. The anomaly, or difference between rated capacity as per cent of total and generated current as per cent of total amounted to 18.6%.

The chief reason for the existence of the anomalies lies in the comparative costs of producing electricity in the established plants serving the area. When, during slack periods, the demand for power is low, it becomes necessary for the operating companies to shut down part of their equipment. Naturally they shut down the plants most costly to operate. As a rule, the steam plants are the ones idled during slack periods because their banked fires represent large savings in fuel costs as well as considerable reduction in maintenance expense.

ECONOMIC STRUCTURE OF POWER PRODUCTION FACILITIES OF NEW ENGLAND

In order to maintain a high degree of industrialization in New England it is essential that an adequate, economical power supply be available. The factor of abundant water-power figured largely in New England's early rise to industrial prominence. For several decades after 1880 water power lapsed in significance, but abundant, cheap coal, easily imported, permitted industry to prosper. The power situation of the last few decades has experienced pronounced improvement. Largely as a result of developments in the electrical industries, water power has been enabled to regain much of its lost importance. Today it generates two-fifths of the electrical energy consumed in New England. Water power again figures as a dominant factor in the stability of New England's industry.

One of the most striking trends in the present development is the tendency to change from private sources of steam and water power, generated within individual manufacturing establishments, to the use of purchased electrical energy provided by power companies. Paralleling this trend, a definite type of power company organization has evolved, exemplified by the concentration of sepa-

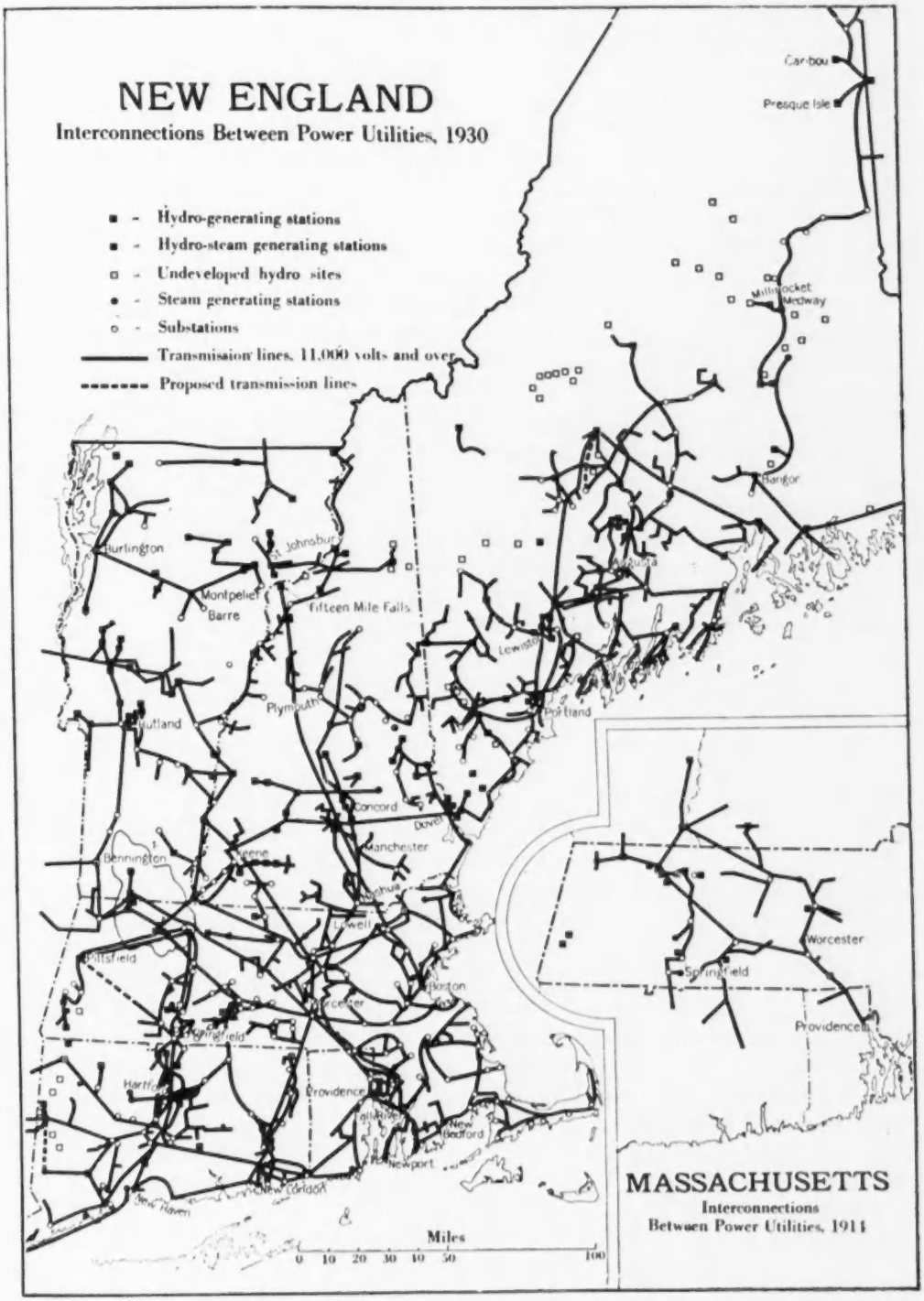


FIGURE 4.—New England interconnections between power utilities, 1930 and 1914. Deerfield River Valley is outlined on the 1930 map. (Reproduced from "New England's Prospect; 1930," American Geographical Society Special Publication No. 16, New York.)

rate power units within central supply systems which serve the industrial users of a wide area.

POWER TRANSMISSION

The process employed in transporting electrical energy from its point of origin to its point of consumption is referred to ordinarily as electrical transmission, and is achieved by the use of high-voltage power lines.

The task of delivering the energy from the generator to the consumer embraces three distinct steps and involves the use of three sets of devices or apparatus. Before the energy is placed on the line its voltage must be "stepped-up" to the pressure required by the line over which it is to be transmitted. The "step-up" process is achieved by sending the electricity through a "step-up" transformer. The next step, the actual transmission of the energy, requires the provision of towers or poles, wires, insulators, lightning protection, and ground protection for the line. The last step includes the various processes involved in delivering the electrical energy by means of a series of "step-down" transformers and distribution lines from the transmission line to the ultimate consumers.

POWER AS A COMMODITY IN TRADE

Power, as a commodity in trade, is affected by factors of geography and economics in a manner similar to other commodities. It must, other things being equal, be generated in those localities where the requisite raw materials can be gathered together and processed most cheaply.

Extensive, economical power production is dependent upon the presence, near at hand, of a large market for "raw" energy. Of all commodities, none is more perishable than electric energy. If it is not used, practically at the instant of its generation, it is lost forever. For all practical purposes electricity cannot be transmitted economically more than three hundred miles, and in addition, power, to be successful as a commodity in trade, must be able to displace "home-made" energy in the market area.

VARIATIONS IN LOADS

Practically every industry and every community has its own distinctive type of load curve. The nature of the variations depends upon a multitude of factors. In industry the nature and extent of use made of electricity and the hours of operation are the principal factors involved. For communities, the number and type of industries, the presence or absence of street railways, the amount of street lighting, and the extent and nature of domestic consumption all influence the normal load curve.

POWER DISPATCHING

The task of coördinating supply and demand for power within the area served by a given power company and the task of redirecting the incoming power to the circuits where it is needed are designated by the term "dispatching." The power dispatcher is the active authority at all times in determining which stations shall be in operation, to what extent they shall operate, and the destination of the generated output. His determinations are based upon a knowledge of load requirements of the market area, in whole and in part, for any specific time or period of time. He, furthermore, knows the available sources of power and the comparative power production costs at all sources during any given period of time.

AVAILABLE SOURCES OF POWER

As far as the dispatcher for the New England Power Association is concerned, there are frequently three sources from which he can draw power or among which he must choose the most economi-

cal. There are the hydroelectric plants of northwestern Massachusetts and the upper Connecticut River Valley; there are the steam electric stations in Providence, Rhode Island, and in Lawrence, Lowell, Worcester, Uxbridge, and Fall River, Massachusetts; and there are the large neighboring systems that frequently have large blocks of power to sell for a few hours at a price lower than it can be generated on the New England Company's system.

INTERCONNECTIONS

By interconnection is meant the physical connection of two transmission systems to each other in such a way as to permit the delivery and measurement of electric energy in either direction between the two systems. Interconnections, in general, are of two not entirely distinct types: interconnection to provide centralized production, and interconnection for mutual aid.

Interconnections to provide centralized production has for its object the tying together of many small isolated and scattered plants and through such interconnections to make a network that will permit the substitution of single or more efficient generating sources for the many scattered and isolated plants. Interconnection for mutual aid is a late development between systems that are normally completely independent; and its primary objects are to dispose of surplus power, one system to another, and to provide for mutual aid in times of emergency. Figure 4 shows clearly the growth and present-day importance of power line interconnections in New England. In general, New England's power system may be considered as one single, great, minutely integrated unit.

SUMMARY

As Deerfield Valley contains no major industrial area the market for electricity within that region is distinctly limited and falls far short of the electrical output of the hydro plants on the river. Consequently there is a huge surplus of energy available for export to markets in the more highly industrialized parts of New England. It is estimated that well over 95% of the electricity generated in Deerfield Valley must seek a market outside the valley of its origin.

Because of the intricate network of transmission lines over which the electricity goes to its market it is practically impossible to determine the exact destination of any power entering the system over an average period of time. Most of the Deerfield power enters the system by way of the central substation at Millbury, Massachusetts. From there it is dispatched to those parts of the system where its service is required.

In the open power market of New England, Deerfield power, as well as all other hydroelectric power, meets both the competition and complement of steam generated electricity. Steam power, generated with coal as a fuel, is produced cheaply along the New England seaboard and at inland points with favorable freight rates.

In conclusion, Deerfield River Valley, since earliest settlement a considerable producer of power, has entered upon the modern phase of its power development. In its new situation it constitutes a relatively small unit of a large and well established system which, in turn, is but a section of the greater New England network of power systems.

THE COAL RESOURCES OF CHINA

W. Belden and M. Salter

THE actual extent and distribution of coal reserves in China is a matter of considerable controversy. The accompanying maps present graphically the most recent statistical information available. Figure 1 has been based upon the estimates of W. H. Wong in the *China Year Book* for 1933, and he considers his statistics to be the most accurate available. Figure 2 has been constructed on the basis of known producing areas listed in the *Commercial Gazetteer of China*, in which the major producing mines are located by latitude and longitude and their production stated. Year Books and other available sources of reference supplemented these data. The two maps show the marked disparity between reserves and production due to a combination of circumstances that has limited development (Table 1).

Coal is widely distributed throughout the country, and, in addition to the striking concentration in the Shansi-Shensi area, many regions have at least an adequate supply for local needs (Figure 1). In the outlying provinces of Sinkiang, Tsing Hai, and Kansu, reserves are known to exist, but no data regarding their actual locations are available; consequently, no attempt has been made to locate these on the map. In the southern provinces of China proper, coal outcrops promiscuously along the flanks of the mountains. This facilitates local production. Wong states that: "It is difficult to go a distance of fifty miles anywhere in Yunnan without seeing some outcropping coal . . . and in Fukien it is so plentiful that even the poorest people keep their fires lighted day and night, as rekindling is found to be more expensive." Of the deposits in Northern China, those of the Shansi-Shensi region are by far the largest, although at the present time production is limited to such an extent that they are of little more than local importance (Figure 2). The Kailan area, on the other hand, with much smaller reserves, is of great significance, owing to its more favorable location for exploitation and marketing.

Estimates of coal reserves in Manchukuo vary between 2,711,000,000 metric tons and 4,804,000,000 metric tons. China, as a whole, possesses approximately 248,287,000,000 metric tons. The disparity between the resources of the two countries despite the conflicting data regarding Manchukuo, is apparent (Table 1). Most of the known deposits in Manchukuo lie along the flanks of the various ranges of the Changpai Mountains, often as isolated deposits in very rugged country, and are,

TABLE 1

COAL RESOURCES OF CHINA *

Province	*Millions of Metric Tons*
Heilungkiang	1,017
Kirin	1,143
Liaoning	1,836
Jehol	614
Chahar	504
Suiyuan	417
Shansi	127,127
Hopei	3,071
Shantung	1,639
Honan	6,624
Shensi	71,950
Hupeh	440
Anhwei	347
Kiangsi	969
Chekiang	101
Kiangsu	217
Hunan	4,000
Szechwan	9,874
Yunnan	1,627
Kweichow	1,549
Fukien	500
Kwangtung	421
Kwangsi	300
Kansu, Chinghai, Ninghsia	6,000
Sinkiang	6,000
Total	248,287

* *China Year Book, 1933.*

therefore, in many instances, relatively inaccessible. The most important producing area is the Japanese operated Fushun-Penhsihu-Yentai field, which provides 80 per cent of the total Manchukuo production, and the bulk of the export coal. In 1931, of a total production of 9,000,000 tons, this field produced 7,200,000 tons. Other significant, but relatively untouched deposits, are found in the Muling-Mishan district of Central Kirin, the Hokang area of Heilungkiang, and the Peipiao district of Jehol. Unfortunately, much of the coal is low grade and unsuitable for coking; hence its industrial uses are somewhat restricted. The Kailan and Penhsihu coals, being of a superior quality, make hard coke, and are in demand for industrial and naval purposes. Satisfactory coke can be made from the Fushun coal only when it is blended with a type such as that obtained from the Penhsihu field.

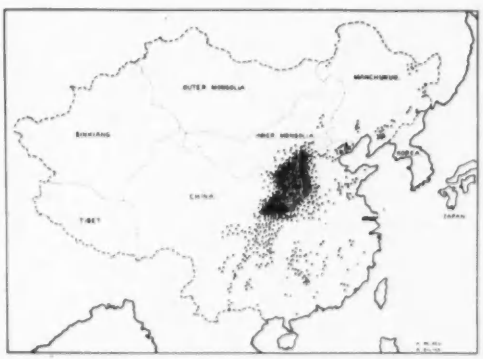


FIGURE 1.—The coal resources of China as of 1931, each dot representing 100,000,000 tons. The Shansi-Shensi area boasts the greatest concentration of resources, though many outlying regions have at least an adequate supply for local needs.

Both bituminous and anthracite coals are found throughout the Shansi-Shensi area, but, as has already been noted, production there is very limited. Rugged topography and inadequate transportation facilities restrict mining operations, and make the reserves of little value, at present, to the industrial centers on the coastal plain. In addition much of the coal, particularly in the North Loess Highlands, is beyond recoverable depth. Although the Shansi-Shensi region is traversed by the Hwang-Ho River, navigation difficulties along this sector preclude its extensive use as a commercial highway. The only railroad into the region is that which connects Peiping with Taiyuanfu, but the cost of shipping coal by this medium is prohibitive. In addition to these unfavorable conditions, internal political instability has materially deterred mining interests. Most of the mines are located in the densely populated valley of the Fen River, and on the eastern and southern fringes of the region adjacent to the North China Plain (Figure 2).

The Fushun and Kailan fields are more favorably located and have adequate means of transportation close at hand. A branch of the South Manchuria Railway, which provides direct communication with the major industrial centers, and with the ports of Dairen and Antung, serves the Fushun area. The Kailan field extends along the coast within easy reach of Tientsin, the chief port of the North China Plain. For this reason, it has an assured bunker trade, and, of late, considerable coastal shipments are being made through the ice-free port of Chingwangtao.

Geological and structural conditions in China are not generally favorable to mining. The coal, for the most part, lies in strata that have been faulted and disturbed by igneous intrusions. In particular areas, accumulations of water in cavernous limestone, folded into and over the coal seams, cause frequent floodings of mine workings. Away from the definite fault planes, roof and floor conditions are not generally bad, but it is impossible to drive large rooms because timber is both scarce and expensive. In

general, therefore, mines are small, and primitive methods are employed to a considerable extent. In fact, the native mines, or those operated by old methods, produce one quarter of the total output of China.

Of the 48 modern mines, those with Chinese capital produce about 33 per cent of the total, while those with Japanese and British capital produce 30 per cent and 11 per cent of the total, respectively (Table 2). The Kailan and Fushun fields both employ modern methods. The open cut at Fushun is unique. The great open pit, started seven years ago, is now 200 feet deep. Two small cuts, three perpendicular shafts, and five inclined shafts, also work in connection with this mine.

TABLE 2

COAL PRODUCTION OF CHINA *

Province	*Metric Tons*
Liaoning	7,698,000
Kirin	580,000
Heilungkiang	230,000
Hopei	7,660,024
Shansi	2,266,337
Shantung	2,093,772
Honan	1,844,739
Shensi	227,278
Hunan	926,000
Szechwan	658,100
Kiangsi	463,144
Anhwei	276,003
Hupeh	275,500
Kwangtung	220,900
Chekiang	234,641
Yunnan	91,155
Kweichow	118,577
Kiangsu	108,338
Jehol	703,144
Chahar	114,500
Suiyuan	91,200
Ninghsia	5,068
Others	350,000
Total	27,244,673

* *China Year Book, 1933.*

The superior quality of the Shantung coal and accessibility of the area have also encouraged modern methods of exploitation. The Chung Hsin colliery at Tsao Chwang served as a model colliery for other mining enterprises. Permanent employees receive a monthly wage of from $7.50 to $58.00 (mex.). Coolies are paid about thirty cents a day, which, because of the extremely low standard of living, enables them to support a family (Table 3).

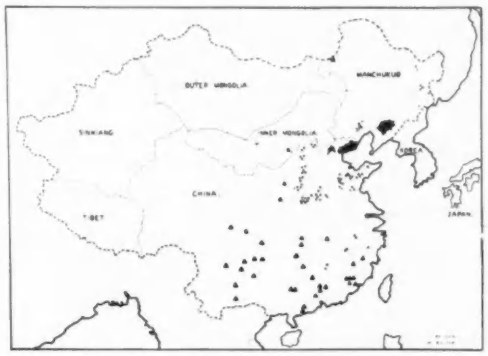


FIGURE 2.—The coal-producing areas of China as of 1931, each dot representing 100,000 tons production and the triangles indicating indeterminate production. Compare with Figure 1 and note the marked disparity between reserves and productions.

TABLE 3

LABOR CONDITIONS IN CHINESE MINES *

Mines	*Total Labor*	*Average Wage*	*Tons Production per Capita*	*Tons Production per Miner*
Mulin (Kirin)	2,200	$1.20	0.44	0.62
Yentai (Liaoning)	1,400	0.53	0.55	0.85
Fushun	52,000	0.46	0.56	1.90
Kailan (Hopei)	32,500	0.52	0.52	0.85
Chinghsing (Shantung)	5,285	0.58	0.47	0.65
Luta	5,219	0.40	0.36	0.60
Peipiao (Jehol)	3,800	0.55	0.45	0.60
Average of 24 counties, mostly North China		0.60	0.43	0.80

* *China Year Book, 1933.*

The total number of mine workers in the whole country, including the laborers in the small native mines, has been estimated at approximately 200,000. This would give a daily production of 0.35 tons per man, making the annual production of coal per capita of labor about 126 tons, as compared to the 200 tons per capita labor production in Belgium, 225 tons in England, and 688 tons in the United States.

The effective development and utilization of China's vast coal resources depend primarily upon: (1) the development of adequate transportation facilities, (2) the establishment of internal political stability, and a stable currency, (3) increased industrial development, and (4) adequate supplies of skilled labor and capital.

ECONOMIC GEOGRAPHY OF BULGARIA

Joseph S. Roucek

BULGARIA, the Scotland of Eastern Europe, as it has been called, is one of the youngest nations in Europe. Like other Balkan states, Bulgaria was under Turkish domination for some five hundred years, regaining its independence in 1878. Thus it is only fifty-five years since Bulgaria regained her right to lead a state life independent from Turkey. During the last fifteen years, Bulgaria has waged three unsuccessful wars; has lost tens of thousands of workers on the battlefield; has spent a large part of her wealth for war; has been compelled to support invalids, orphans, and widows; has ceded territories to neighbors; and has been forced by the treaties to pay reparations and indemnities. If we add to this background, the effects of the present world-wide depression, it is understandable that Bulgaria's economic situation is not an enviable one, in spite of her enormous economic resources and the hard-working peasantry.

Geographical Background

Bulgaria is a continental country with a temperate climate characterized by insufficient, irregular rainfall in cycles of years, seasons, and districts. The temperature varies within a small compass, a variability which induces the development of varying cultures. Bulgaria is more mountainous than Roumania. Genuine plains occupy a little less than one-third of the area. The major part of the plains country lies in northern Bulgaria, the Danube tableland; the remainder consists of the Ztara Zagora Plain and the Maritza Valley south of the Balkan Ridge. The area which may be regarded as agricultural (below 500 meters) occupies about two-thirds of the country. Arable land occupies only a third of the total area.

One may distinguish six main types of soil: (1) brown, slightly podzolized woodland soil; (2) ash-grey, podzolized exposed woodland soil; (3) light brown, heath soil; (4) dark loam; (5) light grey, and red loam; and (6) argillaceous mountain soil. These types cover Bulgaria in belts both wide and narrow which extend from east to west. Through these, in the form of narrow strips, parallel or crosswise, are the soils of river alluvium, and through these in small regions are the soils of other types.

Agricultural Population

Agriculture and the cultivation of cattle form the principal bases of the economic life of Bulgaria, while mineral resources, industry, commerce, and communication occupy a secondary position. Dr. J. S. Molloff of the University of Sofia shows in his discussion of "Bulgarian Agriculture" (in O. S. Morgan, Ed., *Agricultural Systems of Middle Europe*, New York, The Macmillan Co., 1933, p. 48) that of the working population in 1920 74.9% engaged in farming, leaving for all other productive occupations approximately 25%. If the data on occupation are divided on the basis of those actively engaged in work, the extractive producers constituted 81.32% of the working population in that year. Compared with agriculture, other occupations engage insignificant numbers of the people who live, for the most part, in self-supporting homes based upon the tillage of the soil. There is a tendency, it is true, to a slow increase in the ratio of the urban population, but agriculture

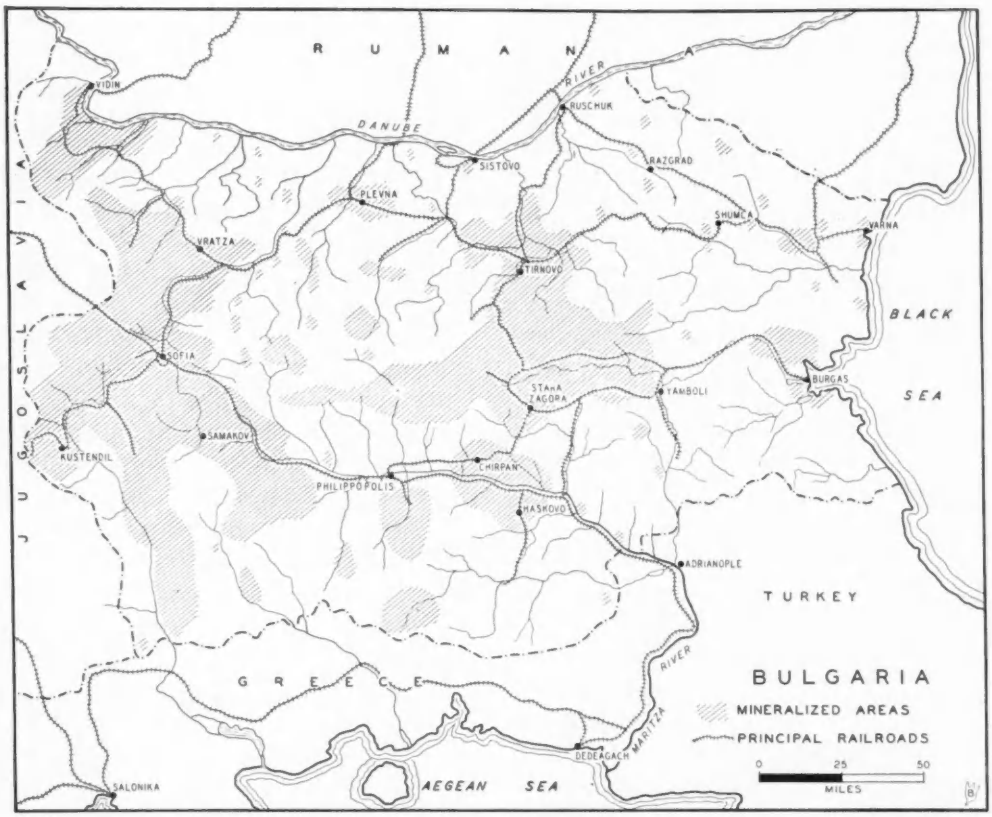


FIGURE 1.—The best utilization of the varied and extensive mineral resources of Bulgaria awaits the expansion of its railway system; but unfortunately many of its mineral deposits are of low grade and require more capital and technological skill in their utilization than Bulgaria possesses at the present time.

remains the most important occupation for the greatest part of the Bulgarian nation.

According to the census of December 31, 1920, the people, occupied and unoccupied, subsisting from agriculture may be distributed as follows:

Farming	3,523,992
Vine Growing	19,218
Gardening	21,900
Forestry	16,072
Bee-keeping and sericulture	786
Hunting	208

Thus a relatively small percentage of the population engages in viticulture, gardening, forestry, etc., while the greatest proportion occupies itself with the growing of crops. The fact that so small a proportion of the farms specialize in vine growing, vegetable growing, stock raising, etc., is a very important characteristic of the Bulgarian agriculture.

These figures, of course, may be related to the extent of the geographical area, which is 39,825 square miles, or approximately as large as the state of Ohio. In 1920 there were 4,846,971 inhabitants which gave a density of 121.7 per square mile; in 1930, the population had increased to 5,944,000, or 142.5 inhabitants per square mile. Thus, in one decade, 1920–1930, the Bulgarian population increased by 1,097,029 persons, an average yearly increase of 109,702 people. The increase is due partly to Bulgarian refugees from Turkey and Greece, but the fact remains that, according to Dr. Molloff, "the population of the country has increased

faster than the arable land, the per capita area is diminishing, and the number of workers per 100 hectares is increasing."

LAND UTILIZATION

One of the most important facts concerning the agricultural production is that Bulgaria is a country of small land holdings. The official statistics of 1926 show clearly that the largest group is represented by the holdings of 10–20 decares, followed closely by 20–30 decares, 10 or less, and 30–40 classes. These four groups include a little more than 45% of the farm holdings of the kingdom.

The number of landholders (large and small), during 1926, was 734,191 distributed as follows:

Size of Farms	*Number of Landholders*	%	*Number of Decares Owned*	%
Under 10 decares	86,323	11.8	429,153.4	0.9
10– 20 decares	90,418	12.3	1,326,784	3.8
20– 30 "	88,064	12.0	2,166,102.2	4.8
30– 40 "	81,150	11.1	2,808,066.2	4.8
40– 50 "	72,011	9.8	3,211,065.2	7.2
50–100 "	206,557	28.1	14,561,172.2	32.6
100–150 "	68,724	9.4	8,260,854.5	18.5
150–200 "	23,281	3.2	2,976,963.9	8.9
200–300 "	12,897	1.7	3,035,302	6.8
300 upwards	4,766	0.6	4,924,404.6	11.0
Total	734,191	100.0	44,699,870.2	100.0

From the above it will be seen that the largest landholders are those with about 60 decares. These lands are, however, cut up into small straggling patches, often a distance apart. At the end of 1929 these fields represented 13,829,930 separate lots, or an average of 15 lots of fields per landholder.

If expressed in acres, 45% of the holdings are less than 10 acres in area, and only 0.6% of the total farm holdings exceed 74.0 acres (that is, 300 decares). The peasants work 80.6% of their own land; 13.3% operate on their own and rented land (the rented land comprising more than one-half of the cultivated land); 3.5% cultivate their own and rented land (the latter including less than one-half of the cultivated land). Only 2.6% spend their time exclusively upon rented land. As in most other central European and Balkan countries, the holdings are divided into small and scattered fields, which, consequently, results in the use of small implements and which precludes the use of heavy machinery. Since the war we can observe

FIGURE 2.—The chief contribution which the modest, picturesque Bulgarian peasant makes to the joy and gayety of the world is the delightful attar of roses, distilled from the soft, golden-colored rose-oil expressed from the blossoms that grow so well among the Bulgarian hills.

an increase in the percentage of the cultivated areas, which in 1929 comprised 39.32% of the total land. The rest consists of pastures, forests, and wholly unproductive soil, which like the forest land occupies over 25% of the total country. Of the total cultivated area in 1929 the tilled land took 89.41%, and land for other purposes (such as meadows, vineyards, orchards, mulberry trees, rose gardens, etc.) comprised 20.59%. But it is interesting that the latter portion, despite the small acreage, plays a very important rôle in the gross income of Bulgarian agriculture.

An outstanding characteristic of the Bulgarian agriculture is that cereals occupy the largest part of the total area of tilled land (an average for the last ten years being roughly 70%). Next, in order of importance, follow the group of fodder plants and temporary meadows, the leguminous group, and, finally, the vegetables. We can observe, also, that with the increase of the sown land there has been an increase in such intensive crops as oleiferous and industrial plants, potatoes, melons, etc. As far as the total average cereal production is concerned, the most important crops such as, wheat, corn, rye, and barley show in reality an increase, although this does not keep pace with the increase in population. The smaller surpluses in cereal production, after the war, resulted in the tremendous decrease in the post-war cereal exports. Compared with other small European countries, Bulgaria has the lowest average yields in cereal production, in spite of favorable growing conditions.

Although the area planted with oleiferous industrial plants is relatively very small (3.93% in 1928) it includes crops which play the most important rôle in the export trade of the country. For example, in some years tobacco comprises 38% of the total export.

Following are the average figures for the area planted in 1926–1930 and 1931:

	Hectares Planted Area	
	1926–30	*1931*
Wheat	1,114,527	1,199,324
Rye	210,392	241,675
Various	98,435	102,973
Barley	238,975	245,657
Oats	135,713	119,485
Maize	685,057	678,359
Rice	7,418	5,779
Tobacco	29,550	30,986
Sugarbeet	18,772	30,986
Sunflower	50,166	95,250
Sesame	5,851	7,170
Cotton	4,903	5,297
Flax	249	712
Jute	3,844	3,744
Lentils	67,491	Figures
Vineyards	89,575	not yet
Orchards	17,721	available
Rose gardens	5,920	

AGRICULTURAL PRODUCTION

The Danube level and especially the areas of Stara Zagora, Bourgas, and Plovdiv in the plain of south Bulgaria comprise the chief wheat-producing regions; the largest yield comes from the southern plains and the Danube levels. The loss of Dobruja, Bulgaria's most important surplus region, to Rumania resulted in large decreases in exports of wheat from Bulgaria.

Maize fields form only about one-fourth of the land under cereals; nevertheless, maize is quite as important as wheat in the northern plain and the high plateau of Sofia. It provides the food for the horned beasts, and supplies the straw stalks used as fuel for the peasant homes. Moreover, the peasants can sow secondary crops such as haricots, potatoes, and pumpkins among the maize, thereby augmenting their supply of food. Most of the Bulgarian barley grows on the plains of the northeast, being used mostly for fodder purposes, for the manufacture of beer, for the distillation of alcohol, and for the preparation of pearl barley. Oats are cultivated mostly in the mountainous parts, around Kustendil and Sofia. Rice grows mainly in the regions of Philippopolis and Tatar-Pazarjik, and to a smaller extent in the neighborhood of Nevrokop.

Rye which is less valuable appears in mountainous districts.

Industrial plants (chiefly tobacco, rape, sunflower, linseed, poppies, cotton, hemp, and sugar beet) occupy an increasingly important position in Bulgarian agriculture. Whereas the area under cereals has shown only a slight tendency in recent years to increase over pre-War areas, that devoted to oil-bearing and industrial plants has nearly doubled, while the production has increased sixfold.

The production of tobacco is now about four times as great as before the World War, and it has become the most valuable of all Bulgarian exports. Over 11% of the state's budget was received from taxation of the tobacco industry in 1928, although the manufacture is in its infancy. One of the peculiarities of the Bulgarian tobaccos is that the medium types contain more nicotine and are especially adaptable for countries in which cigars are being replaced by cigarettes; the high qualities of the small leaf tobaccos, which Bulgaria cultivates to a large extent, and which include the Macedonian tobacco (Nevrokop and Doumaya) and the Bulgarian "Djebel," are very suitable for mixing or blending with the more ordinary tobaccos. The best tobacco plant is grown in the tobacco-growing districts of Xanthi, Kirdjali, Kushu-Kavak, Egri-Dere, Dari-Dere, Sheih Jumaia, Gorna-Jumaia, Nevrokop, Petrich, Melnik, and some others which were acquired by the Treaty of Bucharest of 1913. Although the Treaty of Neuilly gave Xanthi to Greece, Bulgaria retained the important area of the Arda Basin, stretching from Oratkeui to Pashmakli.

One may divide the numerous varieties of tobacco into two main groups based upon the method of manipulation: "Basma," i.e., pressed, and "Bashibaali," i.e., tied head. The latter consist of leaves which, after having been dried, are arranged in bundles of from twenty to twenty-five with their stalks tied together. The former comprise leaves, not necessarily separated from one another, pressed into bundles (The Near East Year Book, 1931–32, p. 201). "Jebel" tobacco is a generic term applied to the tobacco grown in the districts of Kirdjali, Kushu-Kavak, Egri-Dere, Dari-Dere, Sheih-Jumaia, and other fields situated at the foot of mountains (i.e., Rhodope, etc.; "Jebel" means mountain in Turkish). The communities of Gorna-Jumaia, Doupnitza, Philippopolis, Melnik, and Petrich form the nucleus of the tobacco industry. Germany is the greatest consumer of Bulgarian tobacco; then follow Poland, France, Czechoslovakia, Italy, Austria, Belgium, Egypt, and Hungary.

FIGURE 3.—The manufacture of the attar of roses requires considerable technological equipment and training. The distillation of the solution derived from the roses demands careful attention to details of temperature and time.

The present situation is not favorable. The marked decline in demand, particularly for the better qualities, to-

gether with generally lower prices and marketing difficulties in central Europe are combined with the factor of competition from other countries, particularly Greece and Turkey. Furthermore, the tobacco crisis, which has been more or less acute since 1923, may be attributed in part to loss of territory, to general lack of capital, and, consequently, to diminished purchasing power. The government endeavored to adopt helpful measures: in 1930, the authorities greatly reduced tobacco growing in the northern part where the product is of poor quality; it reduced, and in some cases suppressed, exportation taxes; it formed a fund for the encouragement of the industry; and it arranged contracts of sale with groups of financiers and with foreign countries.

Rose culture is a Bulgarian national pride. Bulgaria has been favored by Providence with the largest and most favorable spot in the world for this queen of flowers. Roses are cultivated in one special district, which consists of the two valleys of Tundja and Strema, with Kazanlik and Karlovo as their central towns. The districts extend along a portion of the southern slopes of the Balkan Mountains, comprising in themselves the whole branch range of Sredna-Gora (Middle Mountain), which shoots out of the Balkan Mountains and forms one of the main arms. The best known of the oil-bearing varieties, the "Rosa damascena" (the damask rose), is a semi-double light red rose, having from thirty to thirty-six petals, and possessing an extremely strong fragrance. "Rose moschata" (musk rose) is snow-white. It yields less attar, and lacks the rich scent of the damask rose. There are now in the rose district, which is about one hundred miles in length and thirty miles in width, one hundred and forty villages more or less wholly engaged in the industry, and about 15,400 acres of rose gardens. The distilling process in the same district takes care of about five-sixths of the entire rose crop. It takes thirty damask roses to make one drop of rose oil, and one hundred and eighty pounds, or 32,000 roses, to make one ounce of attar of roses. The chief importers are France, the United States, England, Germany, and Switzerland. This product ranks fourth (following cereals, tobacco, and eggs) in Bulgaria's export trade. At the present, this peculiarly Bulgarian industry is feeling the full effects of the world economic depression and practically no demand for rose oil exists at present.

The following table shows the development of the rose culture, the production of flowers, and its product (attar of rose) from 1903 to the end of 1930.

Year	*Area Planted Decares*	*Production of Flowers in Kilograms*		*Attar of Rose Oil in Muscals*	
		Total	*Ave. per Decare*	*Total*	*Per Decare*
1903...	59,705.6	133,026,000	232.9	847,972	15.20
1905...	73,042.1	13,394,661	190.4	894,464	12.71
1910...	76,055.4	10,400,235	143.1	606,261	8.34
1915...	86,889	12,682,239	154.7	771,108	9.41
1916...	89,288.7	11,436,030	132.1	705,775	8.20
1917...	89,641.4	11,733,821	135.5	681,706	7.90
1918...	84,277.8	8,278,252	101.7	499,743	6.14
1919...	70,909	5,236,604	78.	315,259	4.64
1920...	63,567	5,442,711	89.	340,551	5.57
1923...	45,605.4	5,190,768	116.8	282,496	6.36
1925...	51,552.6	6,815,523	132.	178,708	....
1930...	65,462	7,587,102	116.	178,708	....

There are other industrial plants which have only minor importance. Attempts are being made to intensify the growing of cotton in southern Bulgaria where it has proved to be of good quality. However, the work progresses slowly due to the lack of properly irrigated land. Cotton now grows in twenty-two counties, but in a primitive way. If the large scheme for irrigating the Martiza Valley were realized, it would bring 70,000 hectares under cultivation, and ultimately 200,000 decares (50,000 acres) of land suitable for growing cotton. The sugar beet is grown almost exclusively for Bulgarian

sugar refineries. The vegetable oil industry provides enough for home production and some for export. The export of sunflower seed and oilcake increases steadily. Plum trees occupy more than one-half of the area under orchards. The fruit is either dried for prunes or used for plum brandy. Other fruits include apples, pears, peaches, apricots, figs, and pomegranates. Among the nut trees we find almonds, hazel nuts, and walnuts. Bulgarian cocoons have a good reputation, being developed mainly in south Bulgaria, around Harmanli, Svilengrad, Stankmaka, Mastanli, Dlevna, and Stara Zagora. The low prices of 1930, however, led to a reduction of nearly 50% in the production of cocoons in 1932. Every year, more territory is given over to the Bulgarian vineyards, and more attention is being paid to dessert qualities, of which an appreciative central European market absorbs increasing quantities, although Bulgarian wine is chiefly an article of home consumption. There are no real home brands, but several distinct types of wines are made from different vines. At present, Bulgaria exports wine to Germany, Austria, Switzerland, Czechoslovakia, and the Netherlands.

STOCK RAISING

Stock raising in Bulgaria is nearly always found in conjunction with other branches of agriculture and is subordinated to them, although the livestock resources are important not only for internal needs but also for export. It is evident, however, that the number of cattle is not increasing at the same rate as the population, while the increasing internal consumption of meat tends to

FIGURE 4.—Tobacco drying on racks in the sunshine. Bulgarian tobacco ranks among the best in the Orient, and because of the esteem in which its quality is held, it is an important element in the list of exports from the country. Tobacco is cultivated in the southern and southwestern part of the country, where small sunny valleys with fertile soil are interspersed among the high rugged mountains.

reduce still further the surplus available for export.

The latest census of the domestic animals was taken in 1926, and was as follows:

Horses	481,048
Mules and donkeys	212,315
Oxen	1,807,440
Buffaloes	448,200
Sheep	8,757,223
Goats	1,260,580
Pigs	1,002,015
Poultry	9,091,808

Buffaloes are spread mostly through the northeastern part of Bulgaria; the horse is found chiefly along the Danube, and the mule is limited almost exclusively to the Rhodope districts. Pigs are raised in the southwestern part, while sheep, goats, and cattle are distributed throughout the kingdom. We must notice that the horse is being used more and more for agriculture, although in the towns the horse is being slowly ousted by motor cars. Mules and asses are found in the mountainous districts. Horned beasts are much more numerous than horses, and include bullocks, cows, and buffaloes. Buffaloes are not of any great importance, simply supplementing the bullocks; they live only in warm, marshy parts, but even there their numbers are diminishing. The Balkan Peninsula has always been renowned as a sheep-raising region, and Bulgaria has the distinction of having more in proportion to the number of inhabitants than any other country in Europe. But recently its number has been decreasing, partly as a result of the increase of ground under cultivation, and partly owing to the transfer to Greece and Rumania of lands which served as winter pastures and which favored the support of large flocks. All the breeds are hardy and simple, but give inferior quality wool, which is used for domestic industries, but is not of the kind meeting the needs of modern manufacture.

In every Balkan country, poultry raising is bound up indissolubly with the farm life. The development of the export from Bulgaria of eggs and poultry in particular has enhanced poultry rearing a great deal. But scientific bird raising is very exceptional. The breeds of poultry are simple ones and not very productive. Because of the elimination of Russia from the world egg market, Bulgaria benefited by a substantial increase in her exports of eggs. Of interest is the increasing export of fowls to Italy, and, in a lesser degree, to central Europe. Germany is the chief customer for eggs.

The development of poultry farming in Bulgaria, during the last thirty years, can be seen from the following table:

Year	*Chickens*	*Geese*	*Turkeys*	*Ducks*	*Total*
1900	4,044,545	373,150	199,543	134,513	4,751,751
1905	5,725,080	355,175	185,740	142,257	6,408,252
1910	7,811,642	400,518	236,673	240,020	8,688,753
1920	6,545,892	338,130	249,554	160,459	7,297,035
1926	9,139,296	337,932	313,618	287,028	10,117,874
1930	10,000,000	.....	.....	.....	11,000,000

Beekeeping has also formed a profitable occupation of the Bulgarian peasant from the early years of Bulgaria's existence. Most of the hives are of the old type, but they are being replaced slowly by frame hives which give on the average double the quantity of honey, but slightly less wax. The wax is used for the making of candles which are burned by the pious in the churches.

Although Bulgaria exports the skins of lambs, kids, sheep, goats, hare, and other game, she has considerable imports supplementing her own production of cattle.

AGRICULTURAL POLICY

The future of Bulgaria is bound up indissolubly with the prosperity of her agricultural population. Mm. Athanas Aouzounoff points out in his unpublished thesis, "The Extension Service as Applicable to Agricultural Conditions in Bulgaria" (Rutgers University, May, 1933), that the state policy "toward agriculture can be described as that of

'assisted *laissez faire*,' although in times of emergencies, like the present economic depression, measures such as government action for raising farm prices, tariff, protection, export control, etc., are forms of more aggressive state interference in the agricultural industry of the nation." All observers agree that Bulgarian agriculture must be reorganized. Such plans must take into consideration the conservatism of the peasant, the need of capital resources, the slow adoption of the use of mechanical equipment, and the difficult financial situation of the peasantry and their cooperatives. Mr. T. C. Rapp concludes in his "Economic Conditions in Bulgaria" (Department of Overseas Trade, London, 1932, pp. 37–38), that "at the basis of any improvement must come the distribution of land into economic units. Among other necessary improvements may be mentioned the introduction of better methods of crop rotation, the selection of seed, the scientific use of fertilizers, improved methods of cattle breeding, increased fodder production, the improvement of farm buildings and the combatting of disease. Although the area of land under cultivation shows a tendency towards increase, there are still large tracts which drainage and irrigation could bring into use or improve. The problem of increased agricultural production is of vital importance not merely for the country's trade balance, but also for the maintenance of Bulgaria's rapidly increasing population, with which, it is abundantly clear, production is not at present keeping pace."

Conditions indicate a transformation in the agricu'tural structure of Bulgaria. The country is little industrialized, and the excess of population, finding no outlet in its own industry, and great difficulties in emigration to foreign countries on account of restrictive immigration laws, is forced to remain in agriculture. Viewed in the abstract, such a condition might have two effects. Either the population on land cultivated becomes more dense, or the intensity of cultivation increases. So far as official statistics indicate, little increase in the area of cultivated land has taken place, but a perceptible trend toward intensification in agriculture reveals itself.

American Participation in Bulgarian Agricultural Progress

The need of educating the Bulgarian peasant is intimately connected, we must notice, with American efforts to help in that direction. The Near East Foundation (151 Fifth Avenue, New York) maintains at Pordim, near Plevana, a folk school as a demonstration in practical education for peasant youth. It offers short term courses in farming and animal husbandry to boys, and teaches home-making, simple nursing, child care, and kindergarten work to girls. Furthermore, the school acts as a basis for extension work which includes twenty-eight villages with 65,200 inhabitants in its "zone of influence." The students take an active part in this village work. The course for boys is as yet limited to the three winter months when they can be spared from the farms, but it is hoped to extend the time to a full school year. Practical work in the care of animals and poultry, crop and fruit culture and farm management are emphasized in the course, which also includes classroom lessons and illustrated lectures.

Mineral Resources

So far only a part of the Bulgarian mineral riches has been discovered and of that part only a fraction has been under exploitation owing to lack of working capital and adequate means of transportation. With the exceptions of coal and copper the mineral deposits have not

been utilized to any extent. During the period of 1926–1931 the production of the mines in exploitation was, in tons:

Year	Coal State and Private	Copper	Lead	Zinc	Zinc Lead	Lead Copper	Salt	Aluminium
1926	1,205,758	35,536	11,211	425	.....	.....	1,284	1,889
1927	1,237,646	10,934	1,229	1,495	6,720	16,789	3,982	2,841
1928	1,430,326	10,913	1,324	2,340	14,762	8,787	4,108	2,742
1929	1,651,819	31,370	3,983	1,925	11,396	9,923	3,653	3,613
1930	1,593,041	27,448	.....	.....	2,762	9,737	1,704	5,747
1931	1,522,541	900	.....	.....	.....	.....	3,900	1,382

Over nine-tenths of all the coal produced comes from state-owned mines. Over 80% of that comes from the state mines at Pernik, and the rest from those at Bobovdol and Maritza. Other coal mines worth mentioning are at Platchkovtzi and Borushtitza, owned and operated by foreign and domestic capital. Coal is found in the valley of Maritza and in many other places. The noticeable demand for better quality coal is reflected in the increased production from privately owned lignite, black coal, and anthracite mines.

Formerly four copper mines were being worked: Plakalnitza mine, at Zgorigrad (Vratza); Ikonomov and Troud mines at Bourgas; and Istok mine at St. Nikola (Bourgas). Now all mining operations are suspended on account of the world crisis.

Bulgaria has other mineral resources. There are large unexploited deposits of iron. The principal oil shale region is between Bresnik and Pernik, west of Sofia. Gold may be obtained from alluvial washings near Chekhlare, northeast of Philippopolis. The chief supply of lead is at the Otetchestvo mine at Iskretz, near Sofia; copper and lead are mined at the Sv. Mina mine at Doupni Vrh in the Vratza district, and copper, lead, and zinc at the Sv. Ivan Rilsky mine at Ossikovo in the Vratza district. Other deposits are located in the departments of Kustendil, Trnovo, Pashmakly, and Haskovo, in the Rhodopes, the Iskar Pass and near Berkovitza and Trn. In the Varna region and near Yambole exists manganese, while at Shumu-Bohtchilar in the Shumen Department are aluminum and kaolin. Marble is found in the districts of Peshtera, Stanimaka, Kustendil, and Kazanlik; granite near Philippopolis, Sofia, and Samokov; serpentine, near Philippopolis; gypsum at Mahalata and Iassen (Pleven) and at Trin (Stara-Zagora), talc at Enina (Kazanlik). Salt must be imported; only small quantities can be obtained by evaporation of salt springs at Provadia, near Varna, and of sea water.

The volcanic origin of most of the Bulgarian geologic strata accounts for

FIGURE 5.—Because life is stern and rigorous among the peasants of Bulgaria, every member must aid in wresting a living from the land; and every peasant family, many of them large, occupies itself from early morning until late dusk in the simple primitive agriculture that characterizes the land.

FIGURE 6.—Forests, in which pine and fir predominate, mantle the Rhodope massif. Its ranges are not so lofty as the Balkans, and its charming valleys and pleasant plateaus attract many tourists and holiday makers during the summer months. Lumbering plays no small part in the economy of the country, for one-third its area is forested.

the great number of thermal springs found throughout Bulgaria. At Sofia, Kustendil, Banki, Varshetz, Sliven, and elsewhere are mineral water springs of as high a maximum temperature as 136 degrees Fahrenheit, and of sufficient volume and pressure to make them continuous. The state has erected large, modern bath houses which attract patients from all parts of the peninsula and Europe. At Merichleri, the Bulgarian Vichy, mineral drinking water, containing radio-active ingredients, is being bottled under government control. The more important bathing places include Banki, Ovtcha Koupel, and Gorna Bania, all near Sofia; Vershetz, near Vratza; Hissar, near Plovdid; and Kostenetz, Sliven, Kustendil. The "Momina Bania" (the Maiden's bath), near Kostenetz, is considered to be the third in importance of radio activity in Europe. Along the Black Sea are several beautiful places for bathing; the most important is Varna. The beautiful view and the wide horizon from the heights near the sea at Varna combine with the most modern municipal bathing enclosure to attract thousands of local and foreign visitors, especially Germans, Czechs, Hungarian, Rumanians, and Poles.

FORESTS

Bulgaria has valuable tracts of timber the exploitation of which the Bureau of Forestry supervises. The forest lands represent 28.1% of the total territory. Bulgaria's mountainous character accounts for the comparatively high percentage. The Danubian or Thracian plains contain no wooded land. The densest forests cover the massive mountains of the Rila, Rhodopes, and Pirin. The state owns approximately one-third, and the communes, one-half of the total forest area. The largest and most valuable are those owned by the state. Those privately owned are parcelled in numberless small pieces or patches. The

conifers, which occupy one-ninth of the forest area, consist of spruce *(Picea excelsa)*, 50%; Scotch pine *(Pinus sylvestris)*, with other pines, 35%; and the silver fir *(Abies pectinata)*, 15%. The tree most widely distributed is the beech, with the oak a close second, dividing between them nearly 80% of the area not under conifers. Less than a quarter of these trees attain any considerable size.

The forest industry is but in its beginning, and very few, if any, of the main forests are being utilized. The preparation of timber is still being carried out by the most primitive type of sawmill, mostly driven by small water wheels, the yearly production of which is insignificant. Thus, in spite of the large national forests, Bulgaria continues to import construction and other materials from other countries, mainly from Rumania.

INDUSTRIES

Except for mining, agriculture, and textiles, industry in Bulgaria is but little developed, though from the end of the last century it has been the fixed policy of Bulgaria to support the growth of industries by a protective tariff and by direct support of the creation of new enterprises. This was manifested by the granting of privileges, especially expressed in the Law for the Encouragement of Local Industry of 1928. At the end of 1930 no fewer than 1,264 concerns were enjoying industrial privileges, divided amongst the following industries:

Industry	*End of 1928*	*End of 1929*	*End of 1930*
Metal working	126	137	139
Brick, tile and pottery	82	102	108
Chemical	84	99	113
Food and drink	365	474	524
Textiles	173	204	221
Woodworking	18	47	59
Leather	49	54	56
Paper	...	...	4
Electrical supply	36	41	40
	933	1,158	1,264

This evidently has been an unhealthy and too artificial growth, which has been checked by the drop in purchasing power of the masses. The new government is trying now to bring the prices of agricultural and industrial products into a better relationship.

The most needy are the factories engaged in the manufacture of agricultural products—tobacco factories, tanning mills, and concerns for the production of rose oil. Textile manufacture leads among the non-agricultural industries. Woolen and cotton cloth was woven by hand in the homes of the peasants when Bulgaria was still a province of the Ottoman Empire. The woolen cloth, known locally as "shayak," was made into national costumes by an artisan class of tailors. The widely developed cottage industry, with a network of tailors for the distribution of its products, formed the basis for the creation of a modern textile industry in Bulgaria. A factory to manufacture woolen cloth for the Turkish army was established at Sliven in 1834. After Bulgaria's political liberation in 1879, the government encouraged the woolen industry, with the result that it grew steadily and was adopted gradually in the weaving of finer goods. The center of woolen manufacture, the best developed of all Bulgarian industries, has been, since Turkish times, at Sliven and Gabrovo. But Bulgaria imports the greater part of the raw material consumed in the wool mills. The quality of the Bulgarian material is inferior and is suitable only for the production of rough woolen cloth. The imports of wool and wool yarns for the better grades of goods come generally from France, Belgium, and Italy. The principal center of cotton manufacturing is the Black Sea port of Varna; then comes Gabrovo and Sofia. The greater part of the output consists of plain cloth for general use.

Knitting has developed in Bulgaria as a domestic handicraft, but in recent years factories have been established, mostly in Sofia. Conditions are favorable for sericulture. The equipment of silk-reeling mills, however, is said to be inadequate for dyeing and finishing and most of the goods are converted outside the country.

FIGURE 7.—In the state-owned factories of Bulgaria compulsory or drafted labor is utilized, not only for the production of manufactured goods, but for mobilization and training in unified service under discipline. Bulgaria has been prevented from military preparations, but enforced labor is as good a substitute for a conscripted army as Bulgaria has been able to find. (Courtesy of C. D. Chacaroff.)

TRANSPORT AND COMMUNICATIONS

The Danube, the largest river flowing through Bulgarian territory, constitutes the natural northern frontier. The Danube varies in width from 500 to almost 2,000 meters, and connects Bulgaria via the Danube-Elbe Channel with Hamburg and thus with the Atlantic Ocean. A waterway of gigantic length, reaching from the Atlantic Ocean to the Black Sea, is thus provided by the Danube and Danube-Elbe Channel, which serves as a medium of transportation, rivaled by none, due to the low transportation costs to be added to the price of import and export goods, if transported by water, instead of rail. The Bulgarian ports on the Danube are, in order, from west to east: Vidin, Lom, Kozlodoui, Orehovo, Beshlii, Somovit, Nikopol, Svishtov, and Rustchuk, the more important being Rustchuk, Lom, and Vidin. The only other internal waterway of any commercial importance is the Maritza River, which is navigable for small craft as far as Philippopolis.

The two main ports on the Black Sea are Varna and Bourgas, the latter growing at the expense of Varna, partly because of improved rail facilities, and also because it handles the important tobacco trade. Varna, on the other hand, lost

its rich agricultural hinterland when the Dobruja went to Rumania. Some improvements are also in progress at the smaller ports such as Vallilikо, Anhialo, and Sosopol, which serves coastal traffic only. The Bulgarian Trading and Steam Navigation Company, the only Bulgarian enterprise owning steamships, receives a subsidy from the state.

The state owns and operates virtually all of the railways of the country. In 1929, the length of lines (standard gauge) covered 1,511 miles; in addition 296 miles of narrow gauge lines operated. In 1928, the length of line per 10,000 inhabitants was only 3.1 (4.7 in Yugoslavia, 5.7 in Czechoslovakia, 6.2 in Austria), and 45.4 miles per 1,000 square miles (64.9 in Yugoslavia, 153.4 in Czechoslovakia, 128.4 in Austria). Obviously, the inadequacy of transportation and communication hampers the country's economic situation.

Because of the poor roads and low standard of living, the number of automobiles in Bulgaria is very small; in 1929, 3,701 were registered, of which 2,619 were passenger cars and 1,082 trucks and busses.

During the summer months Bulgaria is served by three foreign air lines, namely the French Compagni Internationale de Service Aerienne, the German Luft Hansa, and the Polish Lot.

FOREIGN COMMERCE

A favorable balance of trade depends mostly upon the success of Bulgarian harvests, since more than 90% of Bulgaria's exports are agricultural and allied products. Another factor is the need to find markets where these products could be sold for a reasonable price. Because of heavy foreign indebtedness, Bulgaria needs a favorable balance of trade. Yet the fact remains that during the post war decade, the imports exceeded the exports. The deficits of 1925, 1928, and 1929 were especially large. In general, the imports during the years 1924–1928 showed a gradual increase, while from 1929–1933 a gradual decrease took place. The principal categories affected were textiles, which averaged 36%; instruments, etc., 12.75%; metal and metal products, 15.2%, etc. In other words, these three categories during the period under re-

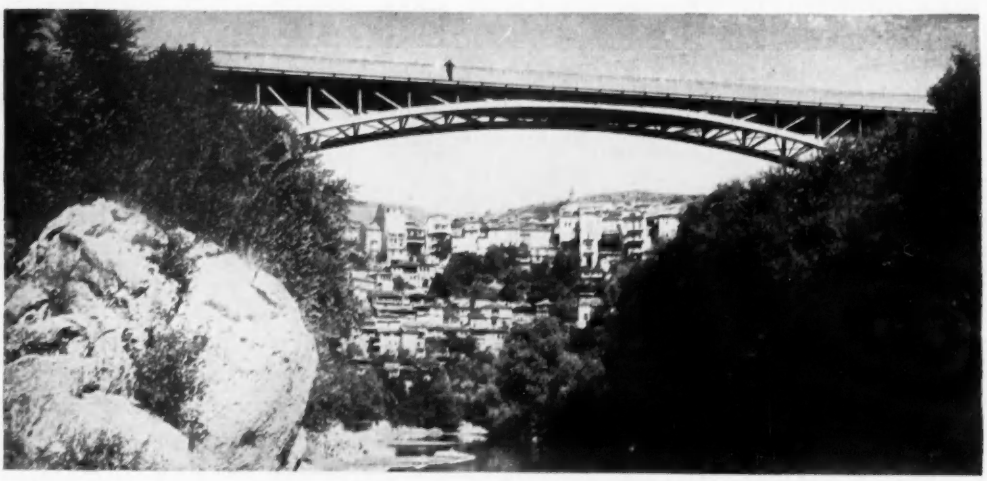


FIGURE 8.—A view of Tirnov the ancient capital of Bulgaria. Its history dates back to 1186, when the second Bulgarian kingdom was inaugurated. It was at this place that the constitution of Bulgaria was adopted in 1879, and the independence of the country from the Turks was proclaimed in 1908. (Courtesy of C. D. Chacaroff.)

view represented 60.7%. The more important articles such as raw and semi-manufactured materials represented 72.3% of the total imports. The reduction in this latter group resulted from the economic crisis in local industry; raw material accounted for only 21.7%. Foodstuffs and colonial goods showed a large increase (5.9) and animal products were insignificant.

The situation during recent years can best be gauged from the following table:

	Imports		*Exports*	
Year	*Tons*	*Value in Thousand Leva*	*Tons*	*Value in Thousand Leva*
1926	311 109	5 630 981	398 862	5 167 600
1927	312 349	6 197 210	466 828	6 627 145
1928	350 981	7 108 747	368 192	6 321 246
1929	505 052	8 324 633	302 376	6 397 061
1930	312 987	4 589 725	533 615	6 191 140
1931	292 934	4 660 162	762 676	5 834 175
1932	261 164	3 471 233	587 941	3 382 845
1933	230 857	2 202 204	430 528	2 846 470

The value of exports expanded in 1930 and 1931 due to two quite exceptionally good harvests. Though foreign trade showed a favorable balance during those two years, the outgoing of foreign exchange to meet the service of foreign loans, reparation payments, and other items, caused the balance of foreign payments to remain unfavorable. Recently, and since 1929, the heavy drop in commodity prices on the consuming markets abroad shows its effects in foreign trade. Thus, in 1932, international trade with Bulgaria decreased considerably as compared with previous years. Exports to the six principal European countries showed a drop of 42%, and imports 46%, as compared with the figures for 1929. Imports reached a total figure of 3,471,233 leva, and accounted for a reverse trade balance, as compared with a favorable trade balance in 1931. All classes of products and goods were affected, principally tobacco, cereals, and eggs. During 1933, the foreign trade showed, furthermore, a greater decrease than during 1932. The imports were reduced in value 36% in comparison with 1932, and exports about 16%. Wheat, eggs, maize, tobacco, and flour show the greatest reduction in exports; as regards imports, the heavy drop was due to the lack of foreign currency for their payment.

In general, principal exports include: cereals, tobacco, eggs, livestock and animal food products, skins and hides, rose oil, silk cocoons, and other agricultural produce. Textiles, as usual, form the most important item in Bulgaria's imports. Raw and semi-manufactured goods for the local industries tend more and more to displace imports of finished products. Other items in imports are: metals and metallurgical products, machinery, tools and appliances, hides and products, timber, mineral oils, fats, paper, vegetable oils, vehicles, and chemicals.

The following table shows, in percentages, the participation of Bulgarian imports and exports with other countries, in value:

	Imports			*Exports*		
	1929	*1930*	*1931*	*1929*	*1930*	*1931*
Germany	22.22	23.22	23.26	29.88	26.18	29.46
Italy	10.66	13.58	13.67	10.48	8.30	5.80
England	8.88	8.19	13.24	1.56	2.06	0.99
Czechoslovakia	8.99	9.37	9.27	4.76	6.39	4.62
Austria	7.63	6.77	7.26	12.55	7.72	16.73
Rumania	7.10	7.99	4.66	0.42	0.37	0.20
Greece	1.14	1.05	0.93	7.59	4.41	1.63
Poland	0.58	1.14	3.10	8.48	10.19	8.26
France	8.17	9.26	7.04	5.14	5.18	3.94
Belgium	2.77	2.40	2.37	4.61	4.90	8.55
United States	3.28	1.88	1.12	1.67	1.03	0.85
Switzerland	2.56	2.83	3.22	2.09	4.22	5.23
Hungary	2.35	1.94	2.23	2.70	3.81	3.04
Holland	2.44	2.99	2.09	1.42	3.35	2.88
Egypt	0.62	0.15	0.12	2.07	2.27	1.98

It is evident that Germany, Italy, Czechoslovakia and England are the principal countries of origin of imports, while Germany, Austria, and Italy are the largest markets for Bulgarian products.

Imports from the United States consist chiefly of agricultural machinery, sewing machines, automobiles, mineral oils, rubber manufactures, and textiles. Exports to the United States consist of

FIGURE 9.—Varna, which has been called the "Queen of the Black Sea," attracts thousands of bathers to its sandy beaches during the summer when fruits and fresh vegetables are abundant and cheap, and when recreation, both on land and sea, are pleasantest. (Courtesy of C. D. Chacaroff.)

hides and skins, carpets, attar of roses, furs, nuts, opium, and cheese.

CONCLUSIONS

The hard-working peasant must be quite bewildered by the fact that he produces plenty, and still he and his country are in a serious economic situation. He is patient and laborious, and devoted to agriculture. Yet his standard of good husbandry is not high, his stock is poor, he is rather ignorant of the use of artificial fertilizers, and his implements are generally, though not always, of a primitive type.

The Bulgarian village is crowded with men. More than 50% of all agricultural holdings support five to ten persons, and more than 60% of the holdings measure less than 50 decares. Bulgarian agriculture is not very profitable. Peasants are in debt nine billion leva to banks, coöperative societies, and private persons. Bulgaria has lost her Turkish and Greek markets, and is seeking buyers on the western European markets. Since 1929, when prices of agricultural products began to fall, Bulgarian agriculture has improved with an increasing yield. But with the fall of prices, rural purchasing power is falling. In 1930 and 1931, it dropped 30% below the 1928 level. Big production and low prices help Bulgarian foreign trade to increase in volume. But, essentially, the crisis in rural Bulgarian economy is rooted in the national economic structure. The fact remains that agrarian production of grain is very unprofitable for small households with too many members. By pursuing a stronger agrarian policy, Bulgaria must make greater effort to improve the living conditions of her 4,500,000 peasants. Climate, geographical position, and fertility of soil—all these represent excellent conditions for agriculture in Bulgaria. Small holdings, lack of capital, absence of agricultural machines, primitive cultivation, excess of human labor, and cultural backwardness constitute the chief obstacles. Vines, fruit trees, roses, tobacco, vegetables, silkworms, and industrial oil-yielding plants should replace grain cultivation. The state should increase means of communication, improve seed, create a good foreign market, facilitate credit for agriculturists, and help toward an improvement in technique. In general, the policy must be directed toward producing agricultural products in which other countries do not compete or in which Bulgaria excels in quality.

Nevertheless, it must be acknowledged that the Bulgarian agriculturist is gradually abandoning primitive ways of farming. In spite of the disadvantages presented by the small divisions of land, investigations reveal an increase of plowers (iron and motor), of sowers, harvesters, threshers, and other machines. This is profitable for the United States, because the kingdom is becoming an increasingly important market for farm equipment in the tractor and harvesting machinery lines. But evidently the situation of the country will not improve rapidly if the prices of agricultural products do not rise in world markets because Bulgaria's economy is dominantly agricultural.

BOOK REVIEW

JONES, CLARENCE F. *Economic Geography.* xvi, 419 pp., 5 pp. Selected Reference, 24 pp. Index. Henry Holt and Company, New York, 1935.

This text for the upper high school or college freshman level is organized around types of industries or occupations. Illustrations are profuse—maps, graphs, and halftones, 334 in all. The halftone illustrations are chosen with special care as to their geographic and educational value. They are simple and legible. Each is designed to illustrate one fact or feature. Yet they are not without their artistic qualities. Aero-survey pictures are numerous and well selected. All have been collected from wide sources. Few are the products of the commercial photograph studios. Many are of the author's own taking. Many of the maps are original and represent much research and careful draftsmanship. The book bears the earmarks of wide, painstaking geographic and educational research, not merely the writing down of a text or information from a higher level. The style is simple, direct, and withal forceful. The author does not play up catchy phrases. He avoids emphasizing the unusual. He varies his approach to the various major units and thus appeals to the children's interest by variety.

The organization is such that the book may be used as a basal text for either a half year or a whole year. Exercises, readings, topics for investigation, and reports provide the additional work to extend the textual material to a full year.

The author divides the book into seven major parts, each part being further divided into chapters. Part I is introductory. In this the author skilfully and interestingly introduces the pupil or student to a population map of the world and the basic maps—relief, rainfall, and temperature region—essential in bringing out the relationships. The pupil is thus introduced early to one of the basal tools in geographic thinking. There are also discussed in Part I the major occupations of man. Part II discusses the fisheries of the world, and Part III the grazing industry.

"The Place of Farming in Human Activity" is the title of Part IV and is rightfully given the largest amount of attention of all the sections, more than 120 pages being used to discuss:

Farming as an Occupation
Plantation Farming in the Tropics
Farming of Marginal Lands
Farming in the Regions of Mediterranean Climate
Grain Farming in the Semi-arid Plains
Mixed Farming in the Temperate Lands
Dairy Farming in Temperate Lands

This part of the book has numerous usable world maps, many being original. Among the more useful are the "Chief Farming Areas" of the world, "Sugar Producing Regions," "Corn Producing Regions," "Coffee Regions," "Wheat," and "Cotton." There are also many regional maps, showing sugar plantations of Cuba, cane and beet sugar in the United States, sugar in Java, the banana region and trade of America, the coffee region of Brazil, the distribution of tea growing in the Far and Middle East, the rubber producing regions of southeastern Asia, the rice producing region of southeastern Asia, rice areas in Japan, sorghum and millet areas, barley in Japan, wheat in southwestern Asia, fiber crops in southeastern Asia, silk producing regions of Asia, regions producing citrous fruits in the United States, grape culture in Europe, apple culture in Europe, and citrous fruits in Europe.

Much use is made of type studies in this comprehensive study of agriculture. The types are briefer than the Charles McMurry studies and are truly typical. Each is accompanied by a regional map or a map of a particular farm. Among these type studies are the sugar centrals in Cuba of the Hershey Corporation, a typical banana farm in Costa Rica, a farm village in east central China, two Japanese farm villages, the Fresno region of California, a spring wheat farm, a hard winter wheat farm, a Texas cotton farm, a corn belt farm, a farm in Scotland, a farm in Norfolk, England, a dairy farm in Massachusetts, a dairy farm in Denmark, and a dairy farm in Scotland. Most of these maps cover a half page or more and are large enough for detailed study by the learner.

The chapters in Part V, entitled "Forestry Industry," view the topic from the world viewpoint—tropical forests, forest industries, naval stores, drugs and other forest products, lumbering in the temperate zone, wood pulp, paper, and, finally, forest conservation.

The remaining thirteen chapters discuss minerals and manufacturing and trade.

The author does not confine himself exclusively to things geographic. Following the present-day tendency in the teaching of the social sciences, he does not hesitate to introduce the learner to related fields when such a deviation makes its contribution toward an enlarged interest, a wider horizon, and a deeper appreciation of the complexity of the modern economic world. The author appreciates the fact that he is writing geography for children. His objectives are child-based rather than subject-based.

A. E. PARKINS

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The April issue of Volume 11 contains the following articles:

Salmon Industry of the Pacific Coast, Otis W. Freeman, State Normal School, Cheney, Washington.
Agricultural Regions of Asia: Part VII—The Japanese Empire, Robert Burnett Hall, University of Michigan, Ann Arbor, Michigan.
Water Power Development on the Deerfield River, A. K. Botts, Cortland State Normal and Training School, Cortland, New York.
A Distressed Industrial Region—Tyneside, George H. J. Daysh, Armstrong College, University of Durham, Newcastle-upon-Tyne, England.
Cultural Adjustments to the Mesabi Resources, Paul H. Landis, National Resources Board, Brookings, South Dakota.
Central Florida Farm Landscape, Samuel N. Dicken, University of Minnesota, Minneapolis, Minnesota.
The Chewing Gum Industry, Charles Landon, Duke University, Durham, North Carolina.
Geography of the Glaciated North Idaho Panhandle, J. Wright Baylor, U. S. Soil Erosion Service, Pullman, Washington.
Agricultural Land Utilization in Denmark, Daniel R. Bergsmark, University of Cincinnati, Cincinnati, Ohio.

January includes:

Geographical Controls of Agriculture in Orkney and Shetland, Andrew C. O'Dell, Birkbeck College, University of London, England.
Seattle as a Port City, Albert L. Seeman, University of Washington, Seattle, Washington.
Agricultural Regions of Asia: Part VII—The Japanese Empire, Robert Burnett Hall, University of Michigan, Ann Arbor, Michigan.
Human Occupance of the St. Clair Delta, Bert Hudgins, Wayne University, Detroit, Michigan.
Dominica: A Wet Tropical Human Habitat, Lucia Carolyn Harrison, Western State Normal College, Kalamazoo, Michigan.
Rural Settlement in North West Devon, England, Beatrice M. Swainson, Lincoln Training College, Lincoln, England.
Economic Geography of Greece, Joseph Slabey Roucek, Pennsylvania State College, State College, Pennsylvania.
The Rayon Industry in Japan, Shinichi Suzuki, University of Hawaii, Honolulu, Hawaii.

The October issue of Volume 10 contains the following articles:

Agricultural Regions of Asia: Part VII—The Japanese Empire, Robert Burnett Hall, University of Michigan, Ann Arbor, Michigan.
Agricultural Occupation of Hokkaido, D. H. Davis, University of Minnesota, Minneapolis, Minnesota.
Spring and Winter Wheat on the Columbia Plateau, Victor Roterus, State College of Washington, Pullman, Washington.
Geographic Aspects of Coal Cargoes From Toledo, Walter G. Lezius, University of Toledo, Toledo, Ohio.
The Sweet Corn Industry of Maine, Albert S. Carlson and John Weston, Dartmouth College, Hanover, New Hampshire.
Future of Lake Superior Iron Ore Supply, George H. Primmer, State Teachers College, Duluth, Minnesota.
The Los Angeles Harbor Fishing Center, Clifford M. Zierer, University of California, Los Angeles, California.
The Development and Decline of Skagway, Alaska, Edwin J. Foscue, Southern Methodist University, Dallas, Texas.

July includes:

Scottish Carse Agriculture: The Carse of Gowrie, Henry M. Leppard, University of Chicago, Chicago, Illinois.
The Tobacco Growing Industry of North Carolina, Charles E. Landon, Duke University, Durham, North Carolina.
The Structure of Rhine Traffic, Edna E. Eisen, Steuben Junior High School, Milwaukee, Wisconsin.
Land Economy of Warren County, Kentucky: Part III, J. Sullivan Gibson, Kanawha College, Charleston, West Virginia.
Pineapple Industry in Hawaii, John Wesley, Coulter University of Hawaii, Honolulu, Hawaii.
A Geographical Survey for Iowa, George T. Renner, Iowa Forest Survey, Anita, Iowa.
Pine Woods Region of Southeastern Texas, William T. Chambers, Stephen F. Austin, State Teachers College, Nacogdoches, Texas.

April includes:

Agricultural Regions of Asia: Part VI, China, George B. Cressey, Syracuse University, Syracuse, New York.
The Bay Oil Industry of St. John, Earl Shaw, State Normal School, Worcester, Mass.
Location Factor in the Choice of Free Port Sites, S. Axel Anderson, Columbia University, New York, N. Y.
Apple Industry of the Wenatchee Area, Otis W. Freeman, State Normal School, Cheney, Washington.
Markets and Market Areas of East Anglia, Robert E. Dickinson, University of London, England.
Furniture Industry of the Southern Appalachian Piedmont, Ben F. Lemert, Duke University, Durham, North Carolina.
Land Economy of Warren County, Kentucky: Part II, J. Sullivan Gibson, Kanawha College, Charleston, West Virginia.

January includes:

Softwood Resources of Europe, Thorsten Streyffert, College of Forestry, Djursholm, Sweden.
Agricultural Regions of Asia: Part V—India, Samuel Van Valkenburg, Clark University.
The Great Valley of East Tennessee, H. C. Amick, University of Tennessee, Knoxville.
Citrus Fruit Industry of the Los Angeles Basin, Clifford M. Zierer, University of California, Los Angeles.
Land Economy of Warren County, Kentucky, J. Sullivan Gibson, Clark University.
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ANNOUNCEMENT

IN THE October issue of ECONOMIC GEOGRAPHY Dr. Samuel Van Valkenburg will continue the *Agricultural Regions of Asia*. In later issues Dr. Homer L. Shantz, President of the University of Arizona, will contribute his series on *Agricultural Regions of Africa* which, upon conclusion, will complete the finest geographic discussion of the world's agriculture thus far established.

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